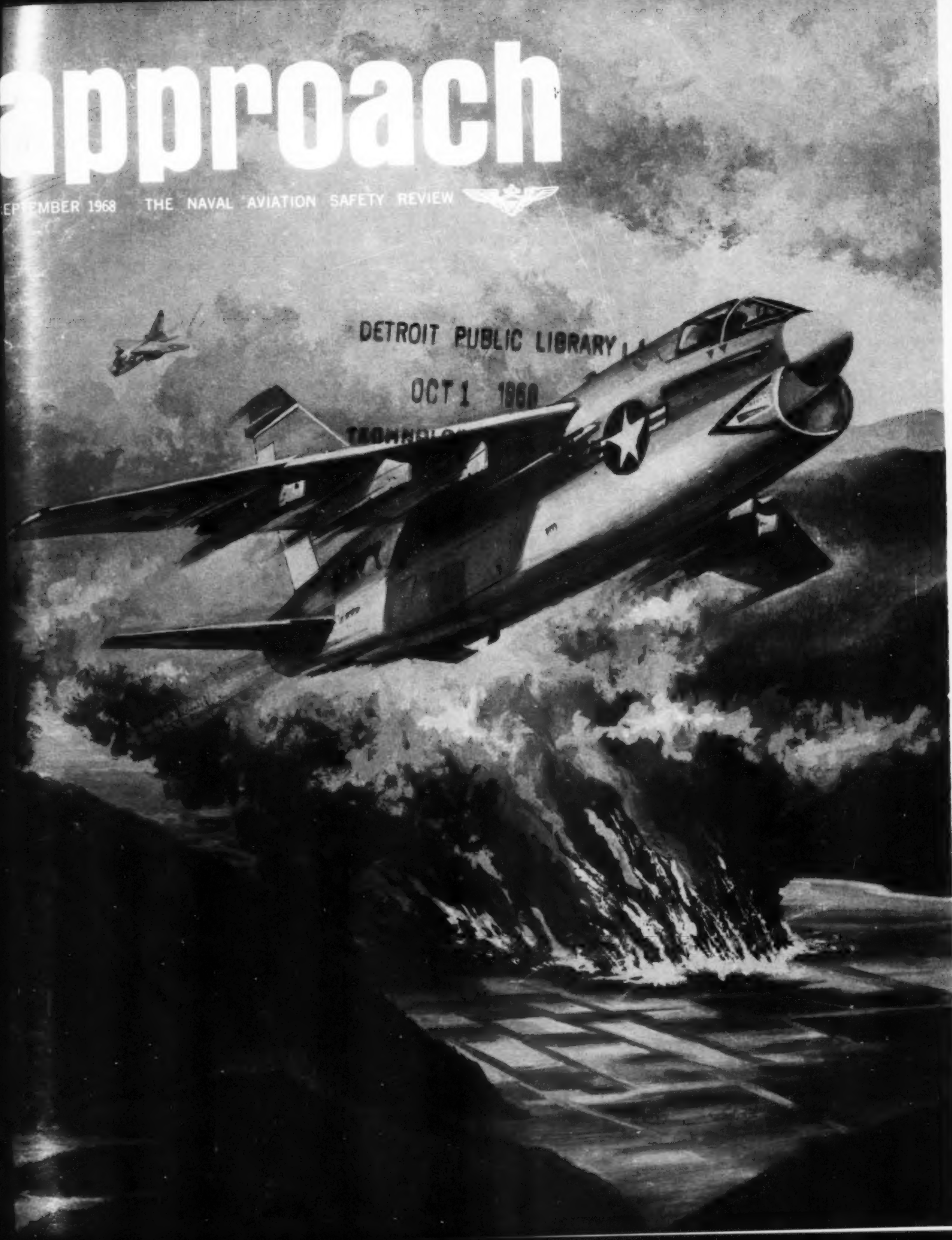
approach

SEPTEMBER 1968 THE NAVAL AVIATION SAFETY REVIEW



MAXIMUM PERFORMANCE:

Plane and Pilot

By COL J. H. Reinburg USMCR (Ret.)

Naval aviators know
that IFR means flying
by instrument flight 1
rules which always
require the best in
pilot proficiency
and, sometimes,
demands maximum
aircraft performance.

Continued next page

When one files an IFR flight plan, it does not always mean that every second of the trip will be in so-called blind conditions. It does mean, however, that the pilot should be fully prepared, mentally and physically, for total reference to his aircraft's instruments at all times.

Clouds are the main ingredients which create total blind flying conditions when one flies within them. Since, however, clouds vary so greatly in size, their presence alone does not always present a total IFR situation. On the other hand, storms are clouds whipped into some degree of a cauldron by heat, wind and moisture. To transgress such storms, one must accept total instrument flight without reservation.

Marginal IFR conditions can also be created by poor visibility in the daytime and, especially, at night without the presence of clouds. This fact is fortified by the article "Night VFR" in the December 1967 issue of APPROACH which points out that visual night flying has its disorientation dangers due to few visual references.

IFR Is Not Routine

Over and above the weather conditions, pilots would be wise to consider their type of airplane when filing IFR. Some considerations should be; (1) Are the instruments adequate?, (2) Is the service ceiling of the aircraft sufficient to comfortably clear the particular terrain enroute? This second consideration must be given some deep thought when traversing mountains because of the ever present possibility of turbulence and downdrafts. Moreover, if there is a chance of picking up ice, safe rock clearance margins can be quickly reduced to the danger point. This subject was partly discussed in the article "Winter Weather Flying Hazards" in the December 1967 issue of APPROACH.

Assuming that the pilot has satisfied himself with these first two factors, he must then determine his own mental attitude toward an IFR flight. If there is any reluctance to follow the IFR plan to the letter, the flight should be cancelled until it can be flown legal VFR. Equally as foolish is the man who presses on regardless, into weather known to be below minimums at destination.

Most pilots give the greatest considerations to the enroute weather and rightfully so. A few, however, when enroute weather is a happy VFR, try to slough over low lying fog at the point of takeoff or landing. A recent takeoff accident is a good example of this.

The Fallacy of Night VFR Takeoffs

The crew of an F-4 was scheduled for a night anti-air warfare exercise. A local IFR flight plan was filed mainly because of low scattered clouds and intermittent ground fog associated with a temperature/dewpoint spread of only 4°. The forecaster noted on the flight plan that fog in the area was causing the visibility to vary from one to four miles. Just before takeoff, departure control notified the pilot that visibility had increased to 4 miles so he modified his plan for a VFR takeoff.

The pilot got airborne in afterburner and had barely snapped up his wheels when he entered one of the forecasted clouds at about 300′. A fearful thought seemed to motivate him to flick the stick forward in order to duck under presumably to remain VFR. A moment later he pulled both engines out of afterburner as if all was going well and then was suddenly alarmed by the illumination of the master caution light. Before he could diagnose the trouble, flames began to hit him in the face. Crunching noises and explosions quickly motivated the crew to eject almost simultaneously. The two chutes barely blossomed out before safely depositing the men close to each other in a heavily wooded area. Both received painful burns but survived.

He Did Not Watch the Gages

Subsequent investigation revealed that the *Phantom II* began striking treetops about $1\frac{1}{2}$ miles after takeoff in four separate clips before finally coming to a grinding and flaming halt in the fourth clump. Along about the third clump, the crew initiated their successful ejection.

The pilot could not accurately recall his actions in those short few seconds after takeoff but, circumstantially, it appears that he should not have cancelled his IFR takeoff and attempted to duck under such low lying clouds. Perhaps he thought he must stay VFR and, therefore, was legally obligated to sneak under the cloud. It is quite easy to figure out what happened. In a heavy tactical fighter like the *Phantom II* such low altitude deviations on takeoff are dangerous enough in clear day weather. It would appear that the combination of ducking under the cloud coupled with the power reduction associated with coming out of afterburner would put the all-weather airplane in a shallow dive. Consequently, quick pilot action would have been necessary to re-establish a positive rate of climb. There is no visual horizon in such conditions so that a VFR takeoff

The F-4 pilot should have had his eyeballs glued to the instruments.

should have been unthinkable. End result—this accident is a perfect example. It is pretty obvious that this pilot, having seen the cloud, was also trying to see other outside objects for references to continue VFR flight—but—there were none—and he was foolish to think so. He should have had his eyeballs glued to the flight instruments so that he never would have seen that crummy little cloud which he would have normally blasted safely through in about three seconds.

Mountains, Turbulence and Ice

Any one of the three subtitle subjects are enough to cause naval aviators anxiety. But—when all three gang up at once—*beware*.

The capability to fly safely over mountains depends on mountain height and engine power available. When such additional handicaps as turbulence and ice are known to be present, certain aircraft may have their safety margins dangerously reduced. Frequent result—collision with stuffed clouds.

In most such accidents, the plane was IFR and the pilots did not see the mountain any sooner than an instant before impact. Every time one of these aircraft-mountain collisions occurs, people often ask themselves, "How could pilots be so much in error?"

If pilots are committed to fly IFR in mountainous country with a marginally powered aircraft, they should and usually do plan the flight over a route around or in between the higher peaks. This means that altimeter settings must be very accurate and radio/radar navigation extremely precise.

Records of mountain crashes through the years indicate that the causes are infinite but, fortunately, the trend shows big improvement because of more powerful engines, better instruments and improved navigation equipment. Unfortunately, there are still in military use, some aircraft whose power leaves little room for error or trouble when trying to get over *mountains* reaching up past 10,000′. Recently a *Skymaster* had the misfortune of being caught in the sky simultaneously by the subtitled three.

The weather forecasted for the route over *mountains* with many peaks scratching the sky close to 10,000′ was for isolated thunderstorms and severe *turbulence* in the vicinity of thunderstorms, snow showers, moderate rime and clear *icing* in clouds

After impact, the C-54 slid back down the mountain.

above 6000′. The wind at 12,000′ was 40 kts from 260 degrees and the temperature was −9° F.

Ice Steals Lift and Adds Weight

Proceeding westward on an IFR plan the pilot of the C-54 reported that he was in and out of heavy *icing* conditions flying at 12,000′. ATC offered him a higher altitude which he declined. Minimum enroute altitude was 11,000′. Just after the pilot reported over a vortac, the controlling ATC made quick calculations which indicated that the *Skymaster's* ground speed was only 90 kts. Five minutes after passing the vortac, the pilot acknowledged an ATC message concerning the altimeter setting at the next omni reporting-in station some 81 miles or 54 minutes (at 90 kts) to the west.

Eighteen minutes west of the last past vortac the pilot transmitted, ". . . we are losing altitude—at ten thousand at this time—unable to maintain one two thousand—over." The controlling ATC answered immediately with a concerned tone, ". . . understand unable to maintain one two thousand—maintain one zero thousand—*please*." This last word "please" had an ominous connotation to it because the plane was already 2000′ below MEA. The aircrew quickly replied, "Roger, we are trying to maintain one zero thousand at this time."

Mountain Wave Downdrafts Spelled Doom

No more transmissions were heard from the aircraft and it was ultimately learned that it crashed into a 9779′ mountain about two minutes later. Altitude of impact was 9500′ MSL, just a little less than 300′ below the peak. Since all aboard perished the full details will never be known.

It is a well known fact that when strong westerly winds are blowing in that western *mountain* area, dangerous downdrafts and *turbulence* exist on the eastern slopes of all mountains. This combined with *ice* signed the death warrant of the obsolete *Skymaster*.

Cause 'Undetermined'—But?

The preliminary investigator concluded that, "The most probable cause of this accident was unusual and severe weather conditions. Analysis of the conditions after the crash indicated the weather to be more severe than forecast; however, the forecasters wrote the best forecast they could with the information available. The pilots of the C-54 exercised sound professional judgment in determining the weather to be satisfactory for this flight."

Mountains Must Be Given Special Thought

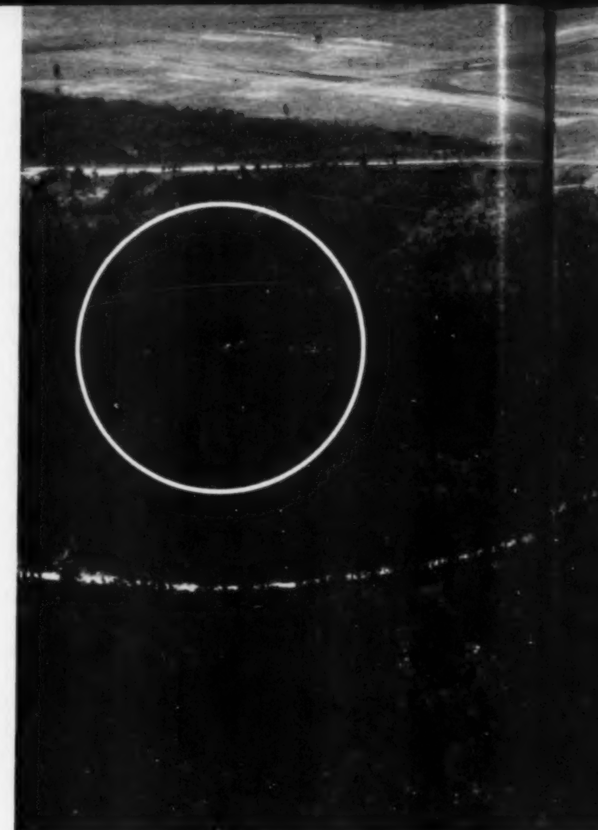
It is difficult to derive a specific safety message from this mishap unless one takes into account the age of the aircraft. The *Skymaster* became an operational military aircraft early in World War II, so that by modern standards, it is an obsolete model. Flight surgeons have, for about the last 25 years, said that aircrews and passengers should be either breathing oxygen or be in pressurized cabins above 10,000′ MSL (or a little less if possible). Regardless, obsolete aircraft such as the C-54 have been safely operating throughout the world flying as high as 14,000′ without any form of boosted oxygen for the personnel therein. If carrying a full load, 14,000′ is also about the service ceiling for the four-engined prop job.

Most aviators know their piloting ability limitations in the form of a *go, no-go* gage within their minds. By the same token, most pilots have some similar *go, no-go* rules which they apply to a specific aircraft's flight characteristics for IFR flights. In these modern days of jet aircraft with pressurized cabins, the time seems to be at hand when unpressurized aircraft should be forbidden to fly IFR over mountains whose heights exceed 6999′. Or stated more specifically, piston engine powered aircraft should not fly IFR over the western mountains.

Out of the Frying Pan and Into the Fire

On a round-robin sea surveillance mission a qualified PPC of an SP-2H filed IFR as per squadron SOP. Moreover, the weather forecast dictated such a clearance. While on patrol, one piston engine developed generator trouble which could not be properly fixed inflight. Night had fallen and the aircraft was about two hours flight from home base and

A needless end for the *Neptune*.



Treetops clawed the *Buckeye* down short and left of the runway.

slightly further from the filed inland alternate. A radio check with home base affirmed that its weather was as forecast on the flight plan. The combination of electrical trouble, nightfall and reconfirmed marginal weather at the home base seemed to dictate a semi-emergency landing at a nearby IFR designated military base. Regardless of the fact that the nearby field had weather as bad as the home base forecast, a decision was made to attempt a PAR approach. Actual weather at the selected airport was light rain and fog with one mile visibility under a 200′ overcast.

Maximum Pilot Performance Was Lacking

Rapcon brought the *Neptune* in nicely and turned it over to GCA about 10 miles out. Everything was still going well until entering final approach. Then the patrol plane pilot could not seem to hold an acceptably safe descent on the glide path because he was always too low. The variation of from 16′ to 100′ continuously worried the final controller because two miles from touchdown he transmitted, "If runway not in sight, discontinue approach, climb and maintain 2000′, heading 140, acknowledge." Although the power on all four engines was increased and the wheels were retracted, the action was not quick enough because the aircraft settled into scrub trees and brush. After about 1000′ of rough skidding, the aircraft came to a crunching stop. Fortunately, all of the crew were able to get out before fire and explosion consumed the aircraft.

Two glaring errors led to this accident: (1) Poor landing field selection in view of the marginal weather; (2) Sloppy instrument flying on the final compounded by poor waveoff technique. Although the electrical trouble was sufficient cause to abort the mission, it was not of such an emergency nature as to support the landing in a marginal weather location. Moreover, the trouble did not detract from maximum aircraft power performance. The main trouble was that the pilots failed when the situation called for maximum performance from them.

So Why Worry About Intermittent Fog

Here is a mishap where good takeoff and enroute weather lured an instructor (and presumed experienced) pilot to be complacent about fog in his planned landing area. The pilot (also an LSO) was to conduct early morning FCLP for a number of students at an outlying field so he had to precede the other *Buckeye* aircraft. As dawn was cracking, the instructor pilot and rear seat student pilot preflighted the T-2B and then started its engines. While taxiing toward the takeoff end of the runway, the tower informed the pilot that his outlying field destination was below minimums due to fog. At the same time, the pilot was informed by the duty officer that his bounce students would not be allowed to takeoff until the destination weather improved. Regardless, the instructor pilot blasted off; as many young pilots are prone to do once they have gone through the tedious preflight bit.

The *Buckeye* arrived over the destination by flying lower than the prescribed altitudes to remain VFR under low level stratus clouds. As was reported, the field was enshrouded in fog but the pilot could see enough landmarks to verify that he was in the vicinity. Making a guess as to the exact location of the hidden runway, the pilot descended through a fog layer and spotted a landmark which he knew was close to the field but he still could not spot the pavement. Consequently, he climbed back on top

and commenced another nebulous attempt with speed brakes extended and 82 percent rpm which allowed a 200 fpm rate of descent. Simultaneous with glimpsing the trees below, he spotted the field pavement at two o'clock. Thinking he had it made, he snapped up the speed brakes and commenced a right turn. Unfortunately, he did not check his rate of descent quickly enough to avoid clipping treetops. He rammed on full throttle and horsed back on the stick. Some more treetops were clipped and the student pilot was heard to yell, "trees" a moment before he pulled his face curtain. More tree clipping coupled with hearing the explosion from the rear seat motivated the instructor pilot to follow the rear seat man an instant later. Both chutes blossomed just in time to deposit the men safely on the ground near each other. Obviously, the aircraft was alpha-ed.

NATOPS Violated

The board's most meaningful comment stated that the pilot was guilty of, "Failure to comply with NATOPS procedures." Poor judgment and an unnecessary press-on-regardless attitude are also glaringly obvious. APPROACH carried an article titled "Why Alternate Airports" in the November 1967 issue which had a mishap like this T-2B accident. Therein, the *Crusader* pilot was more fortunate because he had the assistance of GCA so that he only sprung the landing gear as he lucked through a dangerous last minute S-turn followed by a long and hard landing. He also got away with that press-on-regardless attitude but it is a safe guess that neither of them will repeat it.

Precise Performance Is Required

This article is not written to discourage IFR flights. It is narrated in an effort to contribute toward reducing and, hopefully, eliminating mishaps associated with *known* inclement weather.

Experience through the years has been the basis for the present IFR minima. Many pilots have made successful and safe flights even though they violated minima at takeoff, enroute or landing. Since they were successful, the facts are generally not recorded. But we can bet that most of them vowed not to fly so risky a flight again.

Several appropriate safety slogans with which to end this article might be: (1) Always be sure you are right, and then go right ahead; and, (2) If you have plans for tomorrow, fly safely today.

AIR BREAKS

Common-sense in an uncommon degree is what the world calls wisdom.

Samuel Taylor Coleridge (1772-1834)

Who Really Caused the Accident?

How many pilots have had second thoughts that they should report: a hard landing; an overstress after a high-G pullout; overtemping a jet engine; exceeding MAP limits on a piston engine; excessive use of brakes; lowering the landing gear at too high a speed (or not pulling it up before exceeding gear-down speed); flaps down at too high a speed; and there are others. . . . You know them for your particular bird.

Well about nine-tenths of the time, if you felt guilty, in actual fact, you were blameless. But what about the other one-tenth? Too often accidents (and incidents) happen to naval aircraft which were considered to be the direct result of abnormally hard recent usage. There are others where the crew did not survive to tell their story, and insufficient wreckage was recovered for any meaningful analysis.

We can never be sure but here are some excerpts of accidents/incidents which generate some suspicions that recent previous crews may actually have been the guilty parties.

An F-11A was engaged in high altitude fighter tactics with another *Tiger*. On a pullout, both wings separated from the aircraft. The breaking point was immediately outboard of the wing attachments to the fuselage. The pilot retained some degree of control but could not hold his altitude. He ejected safely. Investigation revealed that the pilot did not exceed the G limits. Suspicion is, however, that someone else did.

A T-28C was being used to teach stalls, spins and slow flight. Following this phase of the hop, approach practice was commenced using a grass field as a simulated airport. At 400′ the instructor took control of the aircraft. Upon the application of power, the engine began cutting out. The mixture was in full rich and the propeller at full increase RPM. Further manipulations of the throttle did not improve the situation and there was insufficient power to maintain level flight. Moreover, the grass field was coming up fast and an unplanned wheels-up landing became the only alternative.

The crew emerged unhurt. Later investigation revealed internal damage to the engine, exact cause —undetermined.

Upon commencing the first of some planned touch-and-go landings, the F-4 pilot made a comfortable touchdown at 135 kts with 3800 lbs. of fuel aboard. When the nose wheel touched the runway, the crew heard a loud abnormal bang somewhere beneath the aircraft. Almost immediately, the nose of the *Phantom* fell through and it skidded to a stop on the radome. The board concluded that the nose strut

gave way due to material failure. Who would like to say that too many hard landings previously had not caused this ultimate collapse?

An SH-34J was cruising along at 80 kts on a ferry flight over mountainous terrain. The need for a little more power seemed evident so the pilot tried to add three inches of MAP. Instead of increasing, the power diminished to such an extent that altitude could not be maintained and sparks were noticed coming out of the exhaust stacks. A forced landing was imminent and the last light of the passing day precluded selecting an ideal spot. The ensuing touchdown wrecked the aircraft but the crew and passengers escaped unhurt. Investigation seemed to indicate valve trouble but the board determined the investigation inconclusive. What do you think?

An A-4 was commencing a practice strafing run when the pilot noticed the utility hydraulic system warning light start to flicker. As the run was aborted both the fire warning and flight control lights came ON. Upon retarding the throttle to idle, fumes appeared in the oxygen system. The engine was shut down and the fire warning light went out. As the throttle was brought back to the idle position, the fire warning light went red again and the throttle was returned to the off position. Other nearby aircraft warned the pilot that he was emitting smoke so he punched out and landed safely. Because the aircraft was demolished, the cause will never be determined. Would you like to make an educated guesstimate?

The moral of this story is; if you think you might have inadvertently done something to an aircraft which could lead to a malfunction or complete failure, report it so it can be double-checked. It is better to admit a small mistake when it happens, rather than contribute to the missing link in an AAR.

Wheels Locked—But—Not Down

An A-4B pilot was practicing night GCAs when he experienced communications difficulty. After making a low pass by the tower, the radio trouble became evident to all hands and he was given landing clearance via green light. This obviated the usual "wheels-down-and-locked" interchange with the tower. The wheels watch man was aware of the radio malfunction and he thought the wheels were down. His equipment, however, for night-wheels-checks, was far from optimum.

The pilot made a good mirror approach and touched down on the centerline about 600′ down the runway. Unfortunately, the wheels were UP and the *Skyhawk* began skidding along on its drop tanks. By a stroke of luck, the tail hook caught the E-5 emergency arresting gear (it is not known how this happened; either the pilot lowered the hook or the aircraft's close proximity to the pavement allowed it to be snagged). This brought the aircraft to rest quickly but not until it had tilted up on the nose. No fire resulted and the drop tanks took the greater part of the damage. The pilot was unharmed.

Subsequent checking found the wheels lever DOWN and the pilot insisted that he had lowered the wheels before the final approach. Later hangar checks on the gear disclosed no malfunctions except for the fact that the light bulb in the gear handle was inoperative. All evidence, therefore, points to the fact that the wheels down actuation occurred just before or just after touchdown because the wheels had barely left the wells when the aircraft was stopped on the runway.

The basic responsibility for wheels-up landings must always rest with the pilot. As a general rule, he is usually given the assistance of others; one being the tower and the other the runway wheels watch. Help from these two, however, is often handicapped by many situations. In this case, radio failure (often cockpit trouble) nullified the tower's help and a poor means of illumination rendered ineffective the total usefulness of the wheels watch.

Some recent tragic incidents involving the use of minimum altitudes for IFR operations indicates that a discussion of this subject might be timely.

Minimum Safe IFR Altitudes

Regardless of what an ATC clearance contains, the pilot is responsible for operating in accordance with Federal Aviation Regulation (FAR) 91.119, Minimum Safe Altitudes for IFR Operations, and OpNavInst 3710.7D, paragraph 561h. The controller however, also has a responsibility to issue clearances which satisfy FAR 91.119.

Essentially, the regulations state that except as necessary for takeoff and landing, a pilot will not operate below the applicable minimum altitude prescribed in FAR Part 95 and Part 97. Part 95 prescribes the minimum altitudes for Federal airways, jet routes or other direct routes for which a minimum enroute IFR altitude (MEA) is designated. It also designates mountainous areas and change over points. Part 97 prescribes standard instrument approach procedures (which include minimum altitudes and weather minimums) for civil airports. Instrument approaches to military airports are prescribed by appropriate military authority.

Obstacle Clearance

For pilot/controller convenience in applying the minimum altitudes prescribed in these regulations, MEAs are published on appropriate aeronautical charts. These MEAs apply to the entire width of that airway or segment between the radio fixes defining that airway or segment. MEAs prescribed for an off airway route or route segment, apply to the airspace five statute miles on each side of a direct course between the radio fixes defining that route or route segment. In some cases, minimum obstruction clear-

A reason for MEA

ance altitudes (MOCA) are prescribed for a particular route in addition to an MEA. An aircraft may be operated at the MOCA only if it is within 22 nautical miles of the vor/vortac/tacan station concerned. Although a MOCA may be prescribed between other fixes, adequate reception of navigational signals is assured only within 22 nautical miles of the station. Operations at the MOCA outside of the 22-mile radius should be conducted only as an emergency measure.

If no applicable minimum altitudes are prescribed in Parts 95 or 97 (depicted on your charts), pilots/controllers must use the following criteria. FAR 91.119 states that in case of operations in designated mountainous areas, an altitude of at least 2000′ above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown will be maintained. In other than designated mountainous areas, an altitude of at least 1000′ above the highest obstacle within a horizontal distance of 5 statute miles from the course to be flown will be maintained. OpNavInst 3710.7D, is

This mountain rescue comes under the heading of "Precarious Operations."

compatible with this regulation, except that, when naval aviators are conducting an IFR operation outside of control areas (airspace in which some or all aircraft are subject to air traffic control), they must apply a 25-mile criteria in lieu of the 5 miles specified in FAR 91.119. Like the MEAs, these altitudes constitute the minimum safe altitudes for IFR operations.

A Theoretical Example

Although the foregoing requirements are relatively simple, a tragedy can occur from improper application. For example, a pilot is enroute in controlled airspace, traveling from Point A to C, a distance of 200 miles and the MEA is not designated. We will assume that the underlying terrain is at mean sea level with the exception of a single tower (Point B) rising to 2000′ MSL and located 50 miles along the route from point A. The aircraft is being operated at 3000′ MSL (not in mountainous area). At what point after passing point A may this aircraft be descended below 3000′? The answer is—the aircraft may be descended to a lower altitude 5 miles after passing the obstruction (point B). There is, however, only one *small* question which must be answered and that is a *positive determination must be made* that the aircraft is 5 miles beyond the obstruction. Let us reemphasize this point, *a positive determination must be made* that the aircraft is 5 miles beyond this obstruction, or to put it another way, he has completed this route segment of his flight. (Outside of controlled areas, naval aviators would apply 25 miles.) Pilot determination can be made using two methods, that is, use of an appropriate radio fix or through the use of pilotage (seeing where he is through visual reference to landmarks). ATC uses similar methods, i.e., a radio fix or geographical location reported by the pilot or through the use of radar.

Mountain waves in action.

Radio Fixes

What constitutes an appropriate radio fix? Of course, a radio fix which is designated on an approved navigation chart is the most appropriate method to determine if you are clear of the obstacle. Pilot use of random fixes (determined by the pilot) can be downright unhealthy since it may be difficult to determine if he is operating within the normal usable limits of the navigational aid. Still another limitation is a determination of proper angular divergence between crossing radials. Controller use of random fixes are subject to the same constraints. In many cases, however, facility planning personnel will plot and chart, for controllers, random fixes which may be used. Plotting these fixes are subject to the limitations set forth in the FAA publication, Order 7110.7, Subject: Use of Unpublished Fixes. This Order also deals with the use of DME fixes, i.e., DME fixes are preferred in lieu of off-route radials and the radial and distance information must be from a collocated source. Additionally, DME information must be within the normal usable limits of a navigational aid.

If Available, Radar Can Help

In a radar environment minimum vectoring altitude (MVA), charts may be used to assist controllers in adhering to the minimum safe IFR altitudes. The charts are valuable where there are numerous minimum safe altitudes due to prominent obstructions such as mountains, tall buildings or towers. The facility planning personnel should prepare these charts in consonance with the following criteria. (Incidentally, should you have any questions or need any assistance in preparing MVA charts, don't hesitate to contact your FAA air traffic representative (if you have one) or the nearest FAA radar ATC facility.)

Ground radar is a big help.

Some Guidelines

1. Make the center of the MVA chart represent the radar antenna site.

2. Divide the MVA chart into sectors as required by different minimum vectoring altitudes. Configuration of sectors and features to be depicted will vary with local terrain and operational considerations.

Use the next 3 through 8 guidelines where applicable:

3. Depict sectors on terminal MVA charts in relationship to magnetic bearings from the antenna site, radials from vor/vortac/tacans or radar display range marks.

4. Depict sectors on center MVA charts in relationship to controlled airspace boundaries, radials from vor/vortac/tacan, or radar display range marks.

5. To facilitate correlation between vectoring charts and radar displays, make sector boundaries coincident or compatible with map overlay or video map data.

6. Make each sector large enough to accommodate vectoring aircraft within the sector at the minimum vectoring altitude. In some cases it might be desirable to combine adjoining small sectors having different altitudes into a single large sector with one altitude.

7. Establish sector boundaries at last 3 miles (5 miles if 40 miles or more from the antenna site) from the obstruction determining the minimum vector altitude.

8. To avoid a large sector with an excessively high minimum vectoring altitude due to an isolated prominent obstruction, enclose the obstruction with a buffer area whose boundaries are at least 3 miles (5 miles if 40 miles or more from the antenna site) from the obstruction. Do this to facilitate vectoring around the obstruction.

9. Determine the minimum IFR altitude (this is also the minimum vectoring altitude except when 10 (below) applies) in each sector and area by applying FAR 91.119 (a).

10. Establish a higher minimum vectoring altitude whenever the minimum IFR altitude does not provide at least 300′ above the floor of controlled airspace.

11. Insure that minimum vectoring altitudes on charts prepared for terminal systems are compatible with vectoring altitudes established for associated radar instrument approach procedures.

12. Coordinate with adjacent radar control facilities to ensure compatibility of vectoring altitudes.

13. Depict the minimum vectoring altitude in each sector.

14. Periodically review charts for accuracy, and as necessary, revise accordingly.

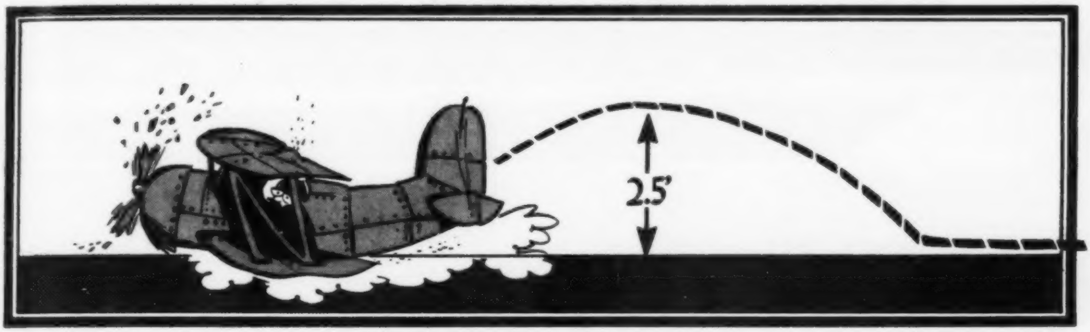
Possible Variations

Pilots should also be aware that during a radar vector it may be difficult to make a personal determination regarding compliance with FAR 91.119 since this altitude may not be the same as along the route you just left. However, you can make a quick "ball-park" appraisal of the situation, i.e., check your approach plate for obstructions, transition and intermediate altitudes, and the minimum safe altitudes. A quick check of the enroute charts will also give you a clue. The best procedure is to carefully study, during preflight planning, the area over which you will operate. One last check you can make is—if in doubt—ask the controller.

One more thing about minimum IFR altitudes, be sure you know the functions and responsibilities of the ground facility with which you are communicating. In other words, if you are depending upon a ground facility to assist you in maintaining a minimum safe IFR altitude—be sure it is an Air Traffic Control facility. The words *radar contact* or communications with a ground facility do not necessarily mean ATC is doing the transmitting. Again, if you are in doubt—don't wait—ask the person with whom you are communicating. Yes, you may be embarrassed, but that's better than becoming a statistic.

Great Aviators I Have Known

By LCDR C. F. Clark



B.D.C. Fox-Brown

Going back a few years, old timers will recall the exploits of that early RAF ace and back yard inventor, B. D. C. Fox-Brown, who developed the gas-driven, nonreturnable boomerang. Concerned about the effects of gamma radiation on pilots, he covered a 1929 Puss Moth with lead and commenced flight testing in the spring of '31. When the craft rose only 2.5 feet after the seventh attempt at flight he abandoned his project as a failure. However, he did prove once and for all the irrevocable axiom that what goes up must come down. (Plane taxied well.)

Boris Crashenburnovich

Who can forget the famous Russian aeronaut Boris Crashenburnovich who pioneered over-the-shoulder ASW weapons delivery. Boris' plan called for a low altitude run-in with a steep pull-up and release of the weapon as the nose passed the horizon, with the aircraft inverted. Having miscalculated the ballistics of the weapon, Boris' plan failed when the weapon passed through his propeller thus making further flight doubtful. However, all was not lost since Boris' flying machine was also testing a vodka-powered engine. The plane crashed in a tomato patch near the town of Schmirov and Boris is credited with inventing the Bloody Mary as a result. It is understood that Boris also discovered a new wing de-icing device while serving 5 to 10 years in a Siberian prison camp.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Here is the Corsair II

By D. R. Wilson
Vought Aeronautics Division Test Pilot

The Navy's new attack aircraft, the *Corsair II*, is now part of the operational fleet. The airplane was derived from the F-8 and looks a lot like it but there are some differences, the most significant of which is the wing. Not only does the shoulder wing stay firmly attached to one spot on the fuselage, it is a good bit thicker and has 5° less sweep than that of the F-8. That relatively thick wing defines most of the airplane's flight characteristics, making it a subsonic lifter of heavy bomb loads rather than a supersonic fighter. The A-7 will never see the high mach numbers of which the F-8 is capable and therefore does not suffer the loss of UHT and vertical fin effectiveness characteristic of that supersonic speed spectrum. A long tail moment arm is, therefore, not required to maintain adequate levels of directional and longitudinal stability allowing a shorter and, therefore, a lighter fuselage to be used. The need for the two-position wing is eliminated because the shorter fuselage affords adequate down, and forward visibility for the pilot.

A Good Low Altitude Jet Engine

The A-7A uses the TF30-P-6A, a turbofan, which has about the same maximum thrust as the non-afterburning J57 but supplies any given level of thrust at considerably less cost in fuel flow. This is particularly true at low altitude so that, unlike most jets, the *Corsair II* is at home below 10,000′. A turbofan achieves its increased efficiency by handling more air than the turbojet. If propulsive efficiency is defined as the useful work performed divided by the energy required to perform it, then

$$\text{Efficiency} = \frac{\text{Drag x Airplane Speed}}{\text{Thrust x Jet Exhaust Speed}}$$

For steady flight in which thrust equals drag,

$$\text{Efficiency} = \frac{\text{Airplane Speed}}{\text{Airplane Speed + Amount the Engine Accelerates its Air}}$$

We all like to be efficient but this tends to say that efficiency goes up as the amount of acceleration decreases and 100% efficiency is reached only if the engine doesn't accelerate the air at all. Of course, some acceleration is essential to thrust.

Thrust = Mass x Acceleration

Thus, a desired thrust level can be achieved with considerable efficiency by moving a large mass of air and accelerating it only slightly. The same thrust can be achieved by moving a smaller mass of air and accelerating it more but the efficiency will be lower (higher fuel consumption per pound of thrust.) The turbofan's greater appetite for air carries with it a high-altitude characteristic which pilots find frustrating. The three, large-diameter fan stages are attached to and turn at the same speed as the low-pressure (front) compressor. At MRT on takeoff, this low-compressor turns at almost 10,000 rpm and tips of the blades in the first fan stage are moving at about 1.35 mach number. If that same RPM were maintained up to 35,000′, the mach number of the blade tips of the first fan stage would increase to 1.55 (because the speed of sound decreases with decreasing air temperature). In order to bring the tip mach number down to about 1.3 at 35,000′, it is necessary to reduce low-compressor RPM to approximately 8300. This function is performed by the fuel control and the pilot sees this as a drop in full-throttle RPM from perhaps 94 percent at sea level to 86 percent at 35,000′. (The RPM the pilot reads is that of the high-pressure, rear compressor.) Turbine inlet temperature drops in a similar fashion (from around the quadrant) to get the RPM and TIT he associates with full thrust. *(The reference to turbine inlet temperature is not a misprint—the TF30 uses this parameter rather than the more familiar turbine outlet temperature.)*

Why Is Compressor Blade Top Speed Noteworthy?

The obvious question is, "What do we care about the blade tip mach number?" Needless to say, those supersonic fan blades are generating multiple shock waves, and above a mach number of about 1.3, the

shock waves cause a significant reduction in the fan's efficiency. Remembering that the fan (or compressor)

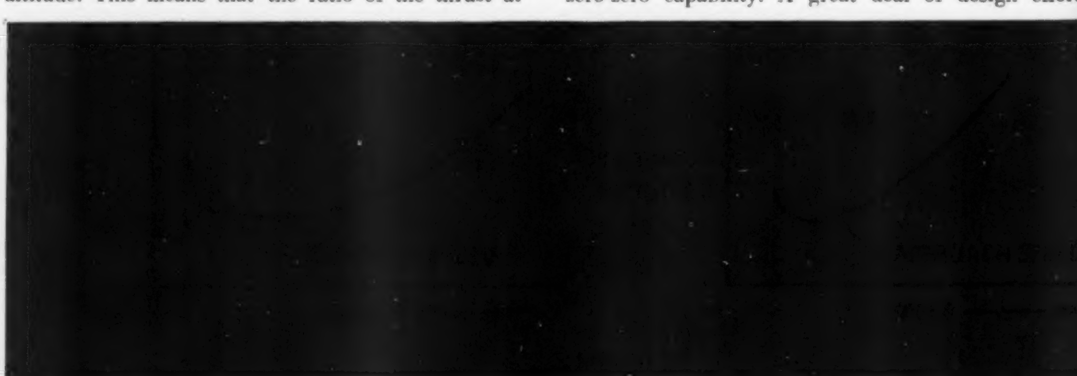
is in the business of adding energy by increasing air pressure and/or velocity, it's interesting to look at the loss in pressure/velocity energy across a normal shock (Figure 1). The lost energy goes into a temperature rise which doesn't benefit anybody. It's hard to develop a feel for why the energy should go to the unusable form of heat, realizing that a shock is a pretty frantic process and bad organization usually means more heat than work. The actual situation within the engine may be a combination of normal plus oblique shocks and this is not quite so inefficient but the important point is that tip mach numbers above approximately 1.3 are very damaging to compressor efficiency. In the case of the TF30, Pratt & Whitney avoids this inefficiency by scheduling maximum fuel flow with compressor inlet temperature—hence, engine RPM and turbine inlet temperature drop at altitude. Obviously, there are limits on how far this drop can go. The specification under which the engine was purchased calls for no more than the normal dropoff in thrust with altitude. This means that the ratio of the thrust at altitude to the thrust at sea level can be no less than the ratio of ambient pressure at altitude to ambient pressure at sea level. Flight tests have confirmed that the engine is delivering this "specification thrust" and the fleet aviator can confirm it by watching his EPR.

The Airplane Juggles a Lot of Fuel

The A-7 carries 10,200 lbs of fuel internally. The fuel is transferred from tank-to-tank and fed to the engine by means of ejector pumps. The ejector pumps have no moving parts and are powered by motive force which is bled from high pressure engine-mounted boost pumps. The pumping action of the ejectors is a result of the transfer of energy from the motive force to the fuel being pumped. The high-velocity motive fuel is introduced into the upstream end of a transfer line and imparts some of its velocity to the fuel surrounding it. This results in flow of both the small amount of motive fuel and much greater amounts of transfer fuel. The ejector system produces a nominal 4-6 psi fuel pressure.

Two Hydraulic Pumps Are Required

Hydraulic pressure comes from two engine-driven pumps (versus the F-8's three). One of the pumps serves both the flight controls and the utility functions, flaps, gear, etc.; however, most of the utility items can be isolated from this hydraulic system after the gear and flaps are retracted. The other hydraulic pump and systems are solely devoted to the flight controls. This flight-controls-alone system can also can be pressurized by a wind-driven emergency power package (EPP). Like the RAT, the EPP can also put out electricity and partially substitute for the main, CSD-driven generator in case of its failure. The flight controls are reminiscent of the F-8—UHT, rudder, spoilers and ailerons. Unlike the F-8, the ailerons are on the outboard portion of the wing. The ejection seat is the *Douglas Escape II* with zero-zero capability. A great deal of design effort



Catapulting the A-7

was put into maintainability and an early check verification program seems to indicate that the airplane needs significantly less than the specified 11½ direct maintenance man-hours per flight hour.

The Automatic Flight Control System

The airplane is fitted with an AFCS that provides a number of good things. The first of these is yaw rate damping. In addition, the pilot may select a control-augmentation mode which provides a constant relationship between lateral stick force and roll rate and between longitudinal stick force and G. The pilot also has the option of an altitude-hold mode with additional options for altitude hold, heading hold, heading select and automatic carrier landing. When in the attitude-hold mode, the AFCS reverts to the control-augmentation mode whenever significant force is applied to the stick.

Carrier Suitability Is Good

Everyone will agree that the F-8 is no piece of cake in the mirror landing pattern. Fortunately, the A-7's wing has given it much better approach characteristics. The difference lies in the shape of the thrust-required curve (Figure 2). Because the bottom of the F-8's curve is nearly flat, a small error in throttle setting can mean a big variation in speed and the F-8 pilot finds himself using the throttle to change

Carrier traps are routine in the *Corsair II*

speed rather than to set speed. Because the A-7 approaches on the "front" side of the curve and because the slope is respectably steep, a selection of the correct throttle setting causes the airplane to seek and stabilize at the correct airspeed (the airplane is speed-stable).

Catapulting

The A-7 employs a nose-tow system for catapulting. The methods of guiding the launch bar to the shuttle and of engaging the buffer-holdback are the same as on other nose-tow-equipped airplanes. The A-7 system differs in that the launch bar is controlled from the cockpit. The shot itself is no different than on bridle-launched airplanes. The catapulting portion of the carrier suitability spotting and loading conditions included shots up to the maximum design catapulting weight of 38,000 lbs. (Weight empty is about 18,000 lbs.) The arrested landing portion included the usual variety of off-center, rolled and yawed and asymmetrically-loaded arrestments plus a dozen free-flight arrestments and two dozen high-sink landings (20 to 23 fps). One dozen of the high sinks were at normal to nose-high touchdown attitudes. The other dozen were very much nosewheel-first. All the free-flights and high-sinks were at the maximum arrested landing weight of 25,300 lbs.

While watching steam catapult shots, you may or may not have noticed a spurt of steam rise from ahead of the shuttle as the catapult is fired. This steam strikes most airplanes in the belly but the geometry of the A-7's nose-tow and intake duct conspire to lead the steam directly to the engine. This, combined with the particular characteristics of the early TF30-P-6 engines resulted in some noisy compressor stalls on the first several catapult shots. Since then, there's been a lot of work by the Navy, LTV and Pratt & Whitney and the problem has been whittled down to size. Catapults have been super-sealed to reduce leakage, the engines have been modified to increase steam tolerance and switches have been placed in the cockpit to select either of two levels of engine bleed (which further increases steam tolerance). Shore-based testing at NATC and NATF Lakehurst, N. J., has been on severely degraded catapults without piston rings and with holes in the piston faces to generate the desired safety margin over actual shipboard catapults. All in all, the *Corsair II* has had as rigorous a carrier suitability trial as any airplane in recent history.

Some Flight Characteristics

Stall speeds are lower than those of the F-8 but the stall itself is a quite natural stall warning in the form of buffet. With flaps down, there is very little pre-stall buffet and stall warning is provided by a rudder pedal shaker triggered by the angle of attack system. Stall recovery is also the same as the F-8's —let go and then feed in a little forward stick. A-7 spins are somewhat similar to those of the F-8 and recovery procedures for both aircraft call for opposite rudder and aileron with the spin. Because the AFCS applies aileron in the wrong (pro-spin) direction in stalls and spins, the lateral portion is disengaged by the angle of attack system at an angle of attack less than stall. Perhaps the most striking feature of the A-7 is its very large speed brake. The brake was sized by a specification requirement to limit airspeed to 400 kts in a 50-degree dive initiated from 35,000′ and Vmax, but it also has other effective tactical uses.

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FORUM:

Do you have a question regarding materials or procedures now in use in Naval Aviation? For an answer send it to FORUM, U.S. Naval Aviation Safety Center, NAS Norfolk, Va. 23511.

Winter Flight Suit

Here's an item which may be of interest to some of your readers. The photograph shows the damage that can result when the winter flying suit (9D-8415-298-5017) comes in close proximity to heat. The wearer of these trousers was approximately 8" from a red hot stove. He was not aware of the "melting" of his suit until several minutes later.

Afterwards we found that the outer two materials of the green "bag" melted quite readily with the flame from a match but the inner layer, next to the body, would not burn even when soaked with lighter fluid. The inner layer of the trousers shown in the photo wasn't even singed.

LCDR J. E. SHEEHAN
ASO, VP-49

▶ Your photograph and account document the fire protection provided by the winter flight suit. (We might note in passing that although the calendar says September, the winter flight suit requirement is year-round for some squadrons deployed in certain geographic locations.—Ed.)

Nomex Flight Suit

During a bailout from a P-2 our bombardier went through a wall of fire, stood up in the nose tunnel with fire up to his waist and after checking the cockpit, climbed out, went aft and bailed out. His nomex flight suit had no scorch marks or singes and the only burns he received were on his hands and face. The inconvenience of the zippers sticking is felt minor compared to the fire resistant qualities of the nomex suit.

LT B. WALSH
VO-67

▶ Your report constitutes a real vote of confidence in the nomex flight suit. Work is underway to improve the zipper problem.

Inadvertent Pararaft Inflation

HS-822 has conducted a pararaft drill to determine the extent of hazard to flying created should the raft be inadvertently inflated while in flight.

A single-man raft, the PR-2A, was worn by a squadron pilot seated in the SH-3A. He had his shoulder harness and seat belt secured in normal adjustment for flight. Upon actuating the inflation toggle on the raft, almost instantaneously (2 seconds) the pressure from the CO_2 entering the raft resulted in forcing the pilot against his straps to a point of crushing his chest sufficiently to be painful. The pilot, being on guard for this, was prepared and released his straps immediately allowing the raft to expand. The raft was pulled out of the plane and it was noticed that the valve had apparently stuck, allowing only one-quarter to one-third inflation. Because the pilot had experienced pain in only a partial inflation, additional drills did not seem advisable for fear of injury.

The following facts and observations resulted from the drill:

1. While it seems very unlikely that the PR-2A raft could be inflated inadvertently, it *is* possible. In this event, a pilot should know what to expect and how to get out of trouble.
2. Should the raft be inflated, the pilot will experience almost instantaneous pressure to a degree sufficient to be painful and possibly enough to cause blackout. The shoulder and seat straps should be released which will force the pilot forward toward the control stick but not fully into the stick. There would be insufficient room to properly control the aircraft without removing the raft. The copilot would naturally take over the controls at this point.
3. It should also be emphasized that there is a correct and incorrect way of wearing the PR-2A life raft. Caution should be taken to avoid wearing it "wrong side in." In an accidental or intentional inflation, this could allow the raft to inflate inside the strap severely crushing the pilot.

CDR J. W. HOPSON
SAFETY OFFICER, HS-822

▶ Thank you for your report. As you say, while it seems very unlikely that the PR-2A raft could be inflated inadvertently, it is possible. Forewarned is forearmed. Perhaps it would be a good idea to carry a raft-puncturing device in the cockpit as some pilots do already.

Unlike the flight control systems on present day high performance aircraft—the Naval Safety Center desires a continued feedback.

Has information in any Safety Center publication ever helped you to prevent an accident, avert an injury, or deal with an emergency in a better way?

If so, and you have not already informed the Safety Center, it is particularly desired and important that you do so. Such feedback is vital to all departments at the Center and for fiscal support of our safety research and educational program.

Short Snorts

Power Failure

During a night instrument training flight in a TA-4F at FL310 with a student pilot in the rear cockpit flying the aircraft under the hood, the aircraft commenced a gentle climb of 1000-1500 fpm. The student countered this with some forward stick and nose down trim. At this time the aircraft commenced a rapid violent pitch up. The instructor pilot pushed forward stick as the student commented, "It's a runaway trim; you've got it"!

The AJB-3A tumbled and spun wildly and the emergency generator was deployed at approximately 200 kts about 30-40 degrees nose high. Horizontal trim override did not overcome the runaway initially as the emergency generator did not come on the line due to nose high attitude and G-loading on the aircraft. There was no electrical power available as the aircraft finally stopped its nose high travel and started nose down at 80 kts, FL360 with 100% power on.

As the airspeed increased in a 15 degrees nose-down attitude the emergency generator came on the line and horizontal trim override was utilized. Power was retarded and a little forward stick relaxed. The aircraft pitched up again and was recovered approximately 60 degrees nose high 100 kts. This time the aircraft was finally leveled at 18,000 ft and 230 kts, 6 degrees nose-high trim. The pitch trim was stuck at 6 degrees nose up. Approach control was contacted, an emergency declared, and an immediate vector given for a straight in approach. When the gear was dropped, the horizontal trim override worked properly. Landing was uneventful. The AJB-3A erected several minutes after the emergency generator came on the line.

One of the dangers involved was the fact that there was no fuel boost at FL310-360, full power on and vulnerable for a flame out. At night and in a very unusual attitude, with no AJB-3A, the generator was pulled. A trim cut out switch as in the A-4C/E may have been useful in this incident.

Popped Hatch

When they stopped at an outlying field to let off a passenger, the pilot and copilot of a US-2B remained in their seats. There was no crewman aboard. After a short delay the passenger let himself out and secured the hatch.

Shortly after takeoff for the return flight the main entrance hatch blew off and was lost. Limited damage was caused when the door slammed against the inboard side of the starboard engine.

The passenger had not been briefed on either normal or emergency procedures for leaving the aircraft. He later stated that he was not familiar with the hatch and that he had first pulled the yellow emergency jettison handle trying to get out of the aircraft. When the hatch didn't open right away he searched around and found the normal hatch release.

He returned the yellow handle to its original position and pushed on the hatch to see if it was still secure. It held, so the passenger thought that nothing had been disturbed. He then left the aircraft.

The main entrance hatch fits tightly on its hinges and the passenger evidently didn't push hard enough to dislodge it. But once the pins on the hinges are pulled by the yellow handle, they cannot be reset by simply returning the handle to its original position.

After the aircraft became airborne, the vibration and slipstream were enough to loosen the hatch and allow it to blow off. Fortunately, the loss occurred while the aircraft was over water and no other damage or injury resulted.

Lost Canopy Again

A pilot in the aft seat of a T-33B was motivated to refer to the NATOPS Manual while the forward seat pilot controlled the aircraft. The document had been loosely stowed along the right side of the seat. In prying the book from its confined location, the

Chained Gear

During a night preflight, both the pilot and plane captain failed to notice a chain tiedown attached to the starboard main landing gear of an AF-9J.

The pilot's first indication of the problem was after takeoff when he raised the wheels and got an *UNSAFE* indication on the starboard main mount. The gear was subsequently checked by the Runway Duty Officer who spotted the chain and directed the aircraft back for an arrested landing. Limited damage resulted.

Preflight to be sure! And look where you're preflighting—to be doubly sure!

Photo shows tiedown chain and dent in speedbrakes.

canopy jettisoning T was snagged and—off went the canopy. The aircraft was slowed down and landed without further incident.

The loss of canopies in T-33Bs has happened all too often. Pilots must be continually cautioned about the sensitivity of the T-handle. Moreover, makeshift stowage in aircraft has led to many accidents and incidents.

Multiple Emergencies

Ten miles out on GCA final the pilot of an RF-4B noticed that his port fire warning light had illuminated. There were no other indications of fire. The pilot reduced the port engine power to idle, but the fire warning light stayed ON. He then secured the port engine.

The warning light still remained ON, but now both generators dropped off the line. Nonplussed, the pilot secured the generator switches and extended the RAT. Continuing down the glide slope, the pilot dropped the gear normally. His hope of avoiding further complications was short-lived when he noticed the starboard MLG indicated UP while the port main mount and the nose wheel indicated DOWN-and-LOCKED.

Still closing the runway, the pilot actuated the emergency landing gear extension system. Normal operation of the flaps was impossible, so he lowered them on the emergency system also.

At one mile on final, the tower now confirmed that the port side of the aircraft was definitely on fire. The pilot continued and touched down at 160 kts, 1000′ from the approach end of the runway. He deployed the drag chute, secured the starboard engine and commenced normal braking. Toe brakes were effective down to a slow taxi speed when they, too, faded. Pneumatic brakes brought the aircraft to an uneventful halt. The crash crew put out the fire and the pilot exited, unharmed. *Substantial damage resulted.*

The pilot in this incident displayed outstanding airmanship and should receive the highest praise. He systematically took care of three emergencies while on GCA final, then had to use another emergency system to stop his aircraft on the deck. If everybody could handle emergencies like this pilot, the accident rate would decline considerably and more of our much needed resources would be preserved.

Remember, an emergency in itself is not a catastrophe, but to be unprepared for an emergency is!

There are two kinds of fools. One says, "This is old, therefore it is better." The other says, "This is new, therefore it is better."
—Dean William Ralph Inge

WIND CH

45	35	25	A 20	15	10	5
				TEMPERATURE	Degrees Fahrenhe	
90°	89.5°	89°	88.5°	88°	88.7°	8[illegible]°
82	81	80.5	80	79.5	78	7
72	71	69.5	68	67	65	6
63	61	59	57	55	52	4
51	49	47	45	42.5	38	2
41	39	36	B 34	30.5	25	1
30	28	25	23	18	11	—
20	18	14	11	6	—2	—1
10	7.5	3	0	—6	—15	—3 Belo
0	—2.5	—8	—12	—18	—29	Below—40
—11	—14	—18	—23	—30	Below—40	
—21	—24	—30	—35	Below—40		
—32	—35	—40	—40			

WIND VELOCITY Miles per hour

Everybody knows it feels colder than the thermometer indicates when the wind blows and accelerates body heat loss but most of us don't realize how great the cooling effect of wind on exposed flesh can be. Whether carrier-based or shore-based, naval aviation personnel have a wind chill problem which is intensified in winter months and in cold water operations. A windswept flight deck or airfield can be a frigid environment and men working in these conditions should wear warm clothing and take precautions against frostbite.

Our reading audience changes continually but the wind chill problem remains. For those of you whose first Navy winter is coming up and as a reference for the rest of us, we again reprint the Army wind chill chart TB MED 81/AFP 160-5, 3 November 1954.

For this table the unit of wind chill is defined as the amount of heat that would be lost in an hour from a square meter of exposed skin surface which has a normal temperature of 91.4°F. The figures in the table are approximate equivalents only and are not to be interpreted as

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85°	87°	86°	84.5°	83°
7	74	72.5	70	60
6	57	53.5	47.5	23
4	39	34.5	20	—11
2	18.5	11	0	—27
1	0	—9	—23.5	C —38
—	—16.5	—40	Below—40	Below—40
—1	—40	Below—40		
—3	Below —40			
w-40				

Instructions for use of table (zero humidity factor):

1. First obtain the wind velocity and temperature forecast data.
2. Locate the column closest to the expected wind speed.
3. Read down to the temperature closest to the expected temperature.
4. Follow across on the same line to the last column in the chart.
5. This figure is the approximate equivalent temperature reading.

For example: The expected windspeed at a given time is 20 mph and the expected temperature is 34°F. Locate the 20 mph column (A) and follow down to the temperature 34°F (B). Move all the way to the right on the same line to the zero (0) windspeed column to −38°F (C). This means that with windspeed of 20 mph and a temperature of 34°F, the rate of cooling for all exposed flesh is the same as at −38°F with no wind.

absolute temperature equivalents. It should be noted further that Army Circular 40-27 states that the term "wind chill" as used expresses only the rate of cooling which occurs in exposed or inadequately protected flesh. Equivalent wind chill figures of +23°F., 0°F. or −40°F., even though they are below the freezing point of water (+32°F.), do not mean that all exposed flesh will freeze solid or even that the surface will be frozen. Regardless of the windspeed, actual temperature readings above 34°F. will never result in freezing of exposed flesh. On the other hand, all unprotected flesh exposed to temperatures below +50°F. may result in cold injury of a type less severe than actual freezing of tissues and referred to as chilblains, trench foot or immersion foot. The lower the temperature, the greater the wind velocity and the longer the exposure time, the greater the chance of cold injury. Many additional factors may contribute to or detract from this type of injury, e.g., physical activity, protective clothing, warming shelters, ground moisture, sunlight, moisture in clothing and extent of fatigue.

The
jungle
can be a

A leaf serves as a drinking cup.

Knowing how to set an animal snare can be an important factor in survival in the jungle.

Shopping Center for Survival

"Number nine poison" snake is the guide's way of saying this snake is not very poisonous. Although this snake is too small for eating, its larger brothers can be an important food source for men lost in the jungle.

To a pilot parachuting to earth over hostile territory, the dense green jungle below may look like his worst enemy. It can be unless he is prepared and trained to survive long enough to be rescued. On the other hand, if you know what to look for and how to use it, the jungle can be a survival shopping center.

Realistic jungle survival training is offered by the Navy in one-day and three-day courses at the Jungle Environmental Survival Training (JEST) School

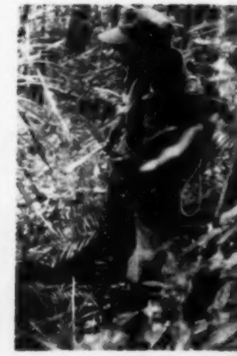
A guide searches along the banks of the Binictican River for a water snake which he observed while hiking with trainees.

A trainee gets a drink from a water vine.

A rain hat can be fashioned from a bonga ba tree leaf.

Continued next page

If you know the right way to do it, you can get meat from a quinine fern without being pricked by its sharp needles. By splitting the center of a quinine fern, you can get its white pulp which combats malaria.



Water and rice are shaken in a section of bamboo which constitutes a crude pressure cooker.

operated by the Fleet Airborne Electronics Training Unit Pacific (FAETUPac) at NAS Cubi Point. The school's instructors are 14 negrito guides who are completely at home in the jungle. Three of them, in fact, were guerrillas against the Japanese in World War II.

The JEST course begins with lectures on jungle hazards and what the jungle offers as food, medicine and shelter. A survival movie is followed by demonstration of enemy weapons and booby traps, then instruction on how to build a fire with bamboo and how to set snares for small game.

A three-mile bus trip takes the 65 or so students into the jungle west of the air station. There the class breaks into groups of six, each headed by a guide. The guides keep a sharp eye for food sources and water trees and vines as they set a rapid pace through the jungle, noting points of interest and answering questions as they go.

In on-the-site instruction, students learn about the six trees and nine vines that provide water; a fern containing quinine to combat malaria; a variety of edible fruits, nuts and plants; tree bark to make rope and bandages; and leaves which can be used for camouflage, mattresses, raincoats, ponchos and

Soup's on! In this instance, the soup is made of snails found in a nearby river.

Bamboo's versatility makes it *the* plant for survival in Southeast Asia. Here trainees carry bamboo to their campsite.

Rice cooked in a bamboo pressure cooker is shared for dinner.

Bamboo pressure cooker filled with rice and water is put on the fire.

The teboy or "6 to 6 tree," is a good source of water in the jungle. The tree gets its nickname because it gives water from 1800 to 0600. The water can be tapped by cutting a "V" slit into the wood.

Continued next page


Trainees practice making rope out of bark.


Two trainees start a fire from bamboo with the help of an instructor.


Trainees practice making fire with bamboo on their own.

drinking cups as well as medicine for minor cuts. Most important of all, the students learn about bamboo, which according to the guides is "*the* plant for survival in Southeast Asia." Bamboo can be used to start a fire, fashion a cooking utensil or a torch, make a bed or build a shelter.

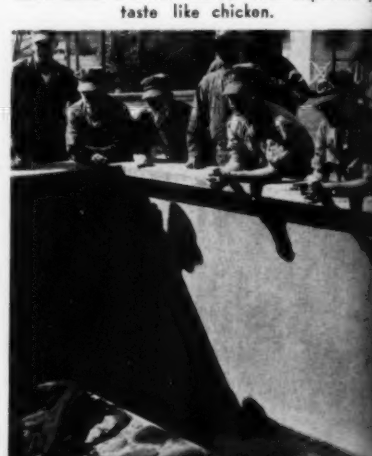
As sunset approaches, the groups come together along the Binictican River to set up night camp. Poles and bamboo are cut from nearby groves for bedding, utensils and fire. At sunset the pale sky is blackened by thousands of large fruit bats which daily wing from caves in Bataan to feeding grounds in Zambales. The students learn that if they could catch one by knocking it out of a tree they would have a wholesome meal. The bats, which often have a wingspan in excess of 4', eat only fruit.

The guides gather clams in the river for soup and meat. Later that night they demonstrate how to hunt resting fish in shallow parts of the river in the light of long bamboo torches carried over their backs.

After a night's sleep on a bamboo bed covered with leaves, the men in the one-day course get up early and march two miles out of the jungle to buses. Three-day students spend another day in the jungle.

JEST is an extension of FAETUPac's survival schools at Whidbey Island, Wash., and North Island, Calif. Most of the men who attend JEST have attended one of these general survival schools. ◄

At the survival school's lizard pool, trainees learn about monitor lizards which reportedly taste like chicken.



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The 6th Mission

The pilot in this story was CAPT John Drew, USMC, the RIO, 1LT William S. Simone.

The F-4B was pulling off the target after its first run when the aircraft was struck by a .50 caliber tracer round. The round entered the left side of the cockpit 10" below the canopy rail, passed through the pilot's left shoulder and the top of his ejection seat and dented the canopy, leaving the pilot seriously wounded. The round or a piece of the debris turned on the Eject light.

The RIO heard the thump and saw the flash. He found himself sitting in a smoky cockpit covered with blood and bits of flesh from the pilot's wound and looking at the Eject light. He asked the pilot if he should eject but there was no response.

Since the aircraft still appeared to be under control, and the target area was a highly undesirable ejection location, the RIO again asked the pilot if he should eject. This time the pilot responded, telling the RIO not to eject yet for he thought that he would be able to fly the aircraft to a safer area. The RIO called on UHF that they had been hit and gave the pilot an immediate vector for the nearest point of the coast. The lead aircraft, engaged in receiving instructions from the TAC (A), did not hear the wingman's initial call and continued the run, pulling off target to hear the second call.

The wounded pilot, who had no use of his left hand or arm, went to CRT and headed for the coast. He attempted to remove a compress from his survival vest to cover the wound but after succeeding in removing the compress from its package, dropped it on the floor of the cockpit and was unable to retrieve it. (Medical personnel who attended the pilot later stated that due to the size of the wound the compress would have had no effect.)

The lead aircraft switched to Guard, made an initial emergency call, and then switched back to SAR primary. Local SAR units were on cockpit alert and in radio contact with the flight. At this point, the pilot stated that he was hit badly but that he would be able to make it to the base which was 70 miles away at this point. He then jettisoned his remaining ordnance over a clear area off the coast.

The RIO told the pilot who had initially removed his oxygen mask to put it back on as a means of preventing shock. Throughout the entire flight, from hit to landing, the RIO kept up a steady stream of conversation to help prevent the pilot from lapsing into shock. The pilot kept stating, "They ain't going to get me!"

Thirty miles out from base, the flight switched to tower frequency. Lead called for a morest, not knowing how much control the pilot would have over landing speed. The pilot was forced to place his left hand in his lap and fly with his right, making power settings and configuration changes with his right hand as well.

At the time of the hit, he had the internal wing tank fuel transfer switch in the stop transfer position. He made several attempts to reach this switch to transfer the internal wings but was unable to do so. When it became apparent that the internal fuselage fuel would be sufficient, he abandoned attempts to reach the switch. The F-4 was cleared for a straight-in approach and made an uneventful landing into the morest. After touchdown, he told the RIO that he was unable to actuate the parabrake. The RIO told him not to worry about it for the morest was in battery and the runway also had BAK-12 gear.

Upon landing, the RIO went forward, installed the seat pins, shut down the engines and helped medical personnel remove the pilot from the cockpit. The pilot was taken immediately to surgery and evacuated the next day for further treatment.

It is noteworthy that the pilot was a first-tour aviator who had been in the combat zone three weeks and was on his sixth mission.

—Maj J. C. Naviaux, ASO VMFA-122

notes from your flight surgeon

Optical Illusion

AN A-4C was No. 2 in a pack of three aircraft for a night launch. All aircraft were started and preflight checks completed. When No. 2 went down due to a fuel leak, the pilot stayed aboard to taxi it into the stack alongside the island. A tiller bar was inserted and an operator stood by. Not knowing why his plane had been downed the pilot checked inside the cockpit for a possible cause.

When he looked outside the cockpit again, he had the sensation that he was rolling backwards from the middle of the flight deck towards the port side of the angle deck. The pilot's first reaction was to step firmly on the brakes. When he continued to believe he was still moving, he dropped the tailhook and secured the engine to signal flight deck personnel to chock the plane's wheels. Sensing no apparent change in rate of motion, he felt he was about to go overboard. At this time he pulled the override switch and raised the gear handle. The nose gear collapsed and the aircraft struck the tiller bar operator injuring him slightly. At no time had the aircraft actually moved.

The pilot had been on deck for almost 30 minutes and feels he had good night vision, the investigating flight surgeon reports. A thorough eye exam ruled out any visual abnormalities. The pilot states he has had such optical illusions before, "as have many experienced aviators I know," the flight surgeon notes. Prior to this the pilot has always distinguished the illusion for what it was before any action was taken.

"This pilot is considered to be competent and well-qualified," the squadron C.O. wrote in his report. "His obvious disorientation or vertigo was caused by his becoming engrossed with switches in the cockpit after it was determined he would not be launched. All pilots have been cautioned about possible vertigo at night while on deck."

Check Connection

INVESTIGATORS in a fatal accident noted that the pilot may have failed to connect his lower rocket jet fittings properly. After strapping into the cockpit, he remembered something he wanted to check, unstrapped, got out of the cockpit, inspected the item and reentered the cockpit. The plane captain thinks he refastened his torso harness fittings but did not actually see him do so. After the accident the shoulder fittings were found connected but the lap fittings were not.

If these fittings were not connected, investigators stated, the pilot could have been incapacitated when the aircraft entered uncontrolled flight. He would not then have had a chance to regain control prior to impact.

If properly connected, rocket jet fittings will not normally unlock in flight. However, it is quite easy for a pilot or plane captain to fail to secure them properly. The importance of positively checking these fittings before takeoff cannot be overemphasized.

Static Electricity

ABOUT to be rescued after ejection, a pilot touched the helo rescue seat before it entered the water. He took a jolt of static electricity.

Survivors should wait until the rescue seat has entered the water before touching it.

Steel Toes

THE FINAL aircraft in the recovery was spotted over the No. 4 cross-deck pendant and was chocked, chained and shut down. An AME1 approached the port side of the aircraft to discuss maintenance gripes with the disembarking crew. During this time the chains and chocks were removed in preparation for re-spotting the aircraft behind the island under the direction of the aircraft handling crew.

After the aircraft began moving back, the director yelled for personnel to clear the area. The AEM1 did not hear the warnings and the port main tire rolled up onto his right foot. His metatarsal bone and three toes were broken.

Investigators pointed out that maintenance personnel and crews should have remained clear of the aircraft until it had been permanently spotted and chocked and that more adequate warning should have been given by the aircraft handling personnel *before* it was moved.

The investigating flight surgeon states that "wearing of steel-toed boots by the injured individual definitely prevented more serious injury than would otherwise have occurred."

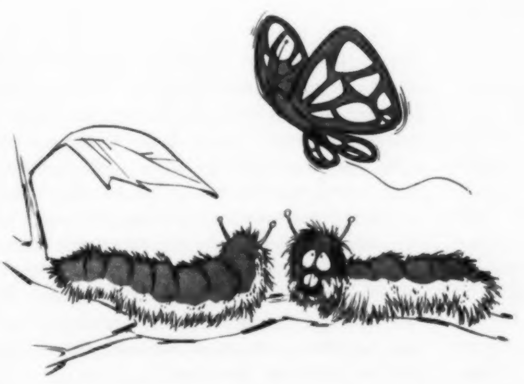
FOLLOW-UP

Supplementary information has been received from the Naval Air Development Center on the new X872 helicopter rescue net (July Approach, p. 31). Detailed instructions of paragraph e of Air Crew Systems Bulletin 146 will be changed to read as follows: "Caution is advised in using the rescue net for personnel transfers to and from non-aviation type ships. Continued use of existing methods is recommended. Use of the net could possibly increase injury hazard because the transferee is in a sitting position and may impact with the deck. As a last resort the net could be used for personnel transfer when other factors clearly outweigh the injury potential." (NavAirDevCen Johnsville msg 121258Z of July refers.)

Recommendation

I RECOMMEND that all rescue helos carry blankets to aid survivors in case of shock, or as in my case, for protection against chill from the night air.

—F-4B pilot after overwater ejection



'You'll never get me up in one of those things!'

"Bump Helmet"

AN A-4E pilot who ejected over water at 1000′ removed his helmet to facilitate entry into the life raft (the hose of his oxygen mask was still attached to the seat pan). When the helo arrived overhead for pick up, he put his helmet back on.

Helo pickup was accomplished "smartly and expeditiously," according to the investigating flight surgeon. The pilot's helmet took a bump on the top edge of the helicopter hatch when he was being hauled in. Without the protection afforded by the helmet, the pilot could have sustained a cut on his head.

Utilizing the flight helmet as a "bump helmet" during helo rescue as this pilot did, the flight surgeon says, is good procedure.

Ear Plugs

DURING a squadron flight/survival gear inspection, the item *most* in absence was ear plugs. It is true that some flightcrew members are not generally called upon to work outside the aircraft; however, they should have ear plugs available. A check will be made on the supply of ear plugs and crewmembers will be instructed to obtain same.

—VP Safety Council

Wrong Way

A PILOT who ejected from an A-4E over water states he pulled both Mk-3C toggles during descent and released the *right* seat pan fitting. This is incorrect procedure. He should have released the *left* fitting so that the seat pan would swing around to his right.

"In this instance only a nuisance was created," the investigating flight surgeon reported. "After a slight bit of fumbling, the pilot was able to inflate the raft."

FEET WET

After pulling off target, an A-4E was hit in the tail section by anti-aircraft fire. Although the aircraft was on fire and the hydraulic systems were out completely, the pilot managed to fly it 70 miles before ejecting at 14,000′ over the ocean. Here is his account of events, followed by that of the rescue helicopter pilot.

"While engaged as leader of a six-plane element of A-4Es on a strike mission, I sustained a hit in my aircraft empennage shortly after pulling off target. Very soon thereafter, the aircraft became nearly uncontrollable. I had no response to stick movement whatsoever. I disconnected, still had no response.

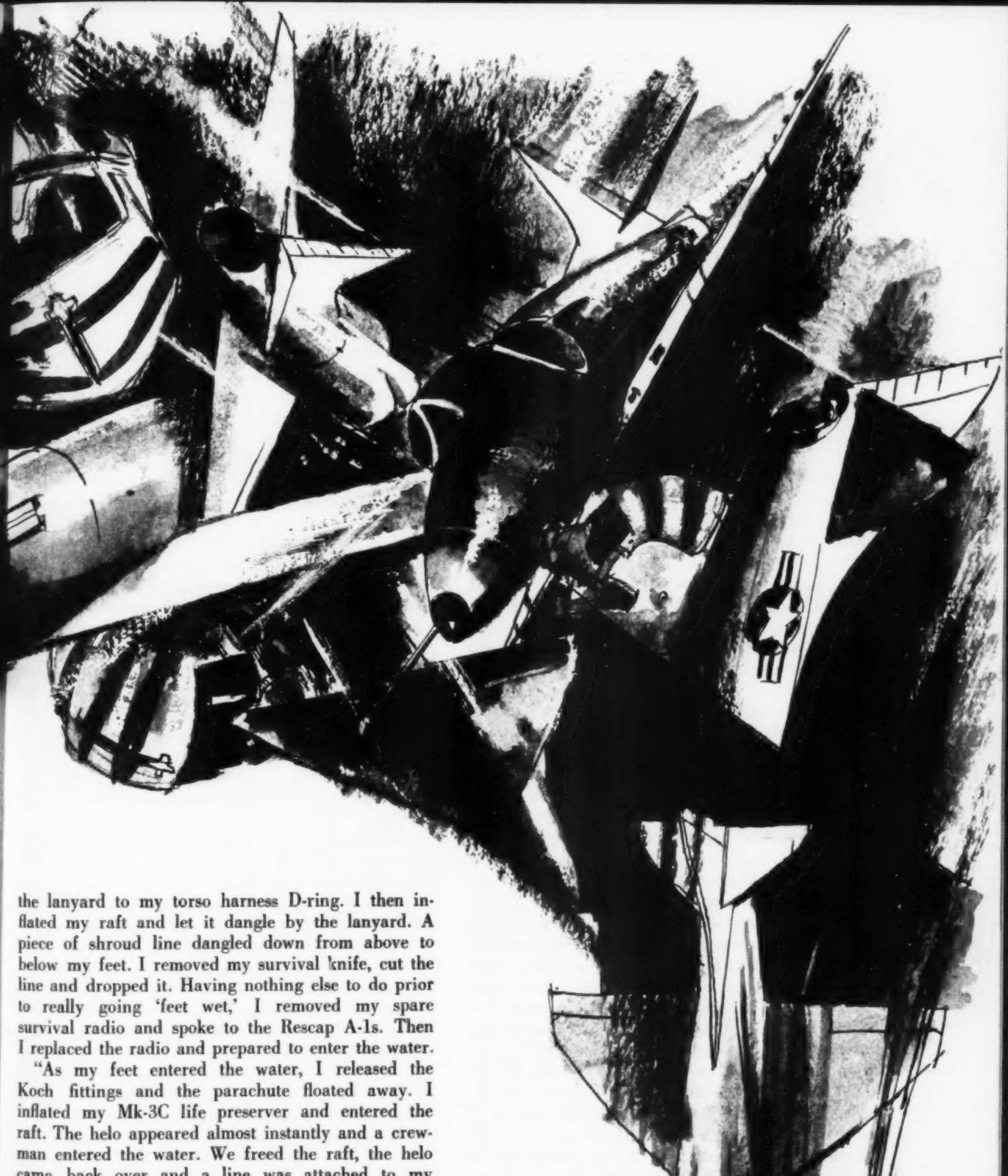
"The aircraft entered a violent series of barrel rolls and at one time, a 1½ turn spin. My wingman called to me to eject, which advice I chose to disregard for the time being.

"Using emergency override horizontal stabilizer control and rudder, I attempted to establish the aircraft heading straight and level. Once in a while I was able to attain a semblance of balanced flight and removed my left hand from the horizontal stabilizer emergency override. (At this time, I had both utility and flight control failure.) Each time, however, the aircraft pitched up violently and started to roll. I finally resigned myself to not being able to use the radio and concentrated on getting to the Gulf of Tonkin. Gradually I worked my way up to someplace between 15 and 20,000′ through a series of barrel rolls and other uncontrolled maneuvers which have not been named yet. I was accompanied throughout by my wingman and No. 4 man.

"Arriving over the Gulf of Tonkin, I attempted to find an area clear of clouds and away from any islands or boats. I slowed the aircraft down to about 250 kts, removed my knee pad, lowered my seat, positioned myself and pulled the face curtain.

"Reaction was prompt and the parachute opened quickly. Although my helmet nape strap was snug against the back of my neck and my chin strap was tight, my helmet rotated forward about 30 to 45 degrees. My head was held forward by risers. I could not breathe so assumed the emergency oxygen bailout bottle failed to function.

"I removed my mask, unfastened my left thigh rocket jet fitting, opened the raft packet and fastened



the lanyard to my torso harness D-ring. I then inflated my raft and let it dangle by the lanyard. A piece of shroud line dangled down from above to below my feet. I removed my survival knife, cut the line and dropped it. Having nothing else to do prior to really going 'feet wet,' I removed my spare survival radio and spoke to the Rescap A-1s. Then I replaced the radio and prepared to enter the water.

"As my feet entered the water, I released the Koch fittings and the parachute floated away. I inflated my Mk-3C life preserver and entered the raft. The helo appeared almost instantly and a crewman entered the water. We freed the raft, the helo came back over and a line was attached to my D-ring. We were taken aboard the helo with no difficulty.

Continued next page

'He called 'feet wet' and about two minutes later advised he was ejecting.' -Rescue Helo Pilot

"All equipment functioned perfectly except for the emergency bailout O_2. The SAR helo crew performed expertly and, in summary, it was what I consider a very satisfactory morning except for losing my first aircraft in 15 years of flying."

The report of the pilot of the rescue helo fills in the picture:

"I was flying as aircraft commander in a rescue helo assigned to a special SAR station just off the coast. We had been on station for approximately 30 minutes when we were informed by a SAR ship that an aircraft had taken a hit over the target and to stand by for a possible search and rescue.

"At that time I headed the helo in a westerly direction. We had no idea of the intended flight path of the damaged aircraft. In a couple of minutes I could hear the Mayday broadcast and the conversation between the wingman and the pilot. Indications of control problems, hydraulic failure and a fire made me wonder if he could be able to make it to the water prior to ejection.

"As the flight path became clear, I received word as to the position of the aircraft in relation to the tacan and our position. We headed on a course of north, northeast for intercept. The scattered to broken clouds at 1500′ kept our escorting A-1 aircraft quite close to me and we moved toward the intended exit point.

"As we proceeded north, I could see the enemy-controlled island areas and flew as wide a path from them as possible. We were clearly in an area of enemy-held territory though still a couple of miles from the mainland. No fire was observed to be coming from any of the islands, for which I was very relieved. The tacan of the exiting aircraft was given to me and the position noted in case of overland ejection. I was able to advise the aircraft that we were in his area and within 12 minutes of him should he decide to eject. He stated he was trying to go just a little further out into the gulf. He called 'feet wet' and about two minutes later advised he was ejecting. His tacan position was given and we were then only about 10 minutes away and in a clear area for rescue. The A-1 aircraft moved on ahead to locate the area. We increased speed. As the chute was descending, our A-1 aircraft reported it in sight. Within minutes we were in the area.

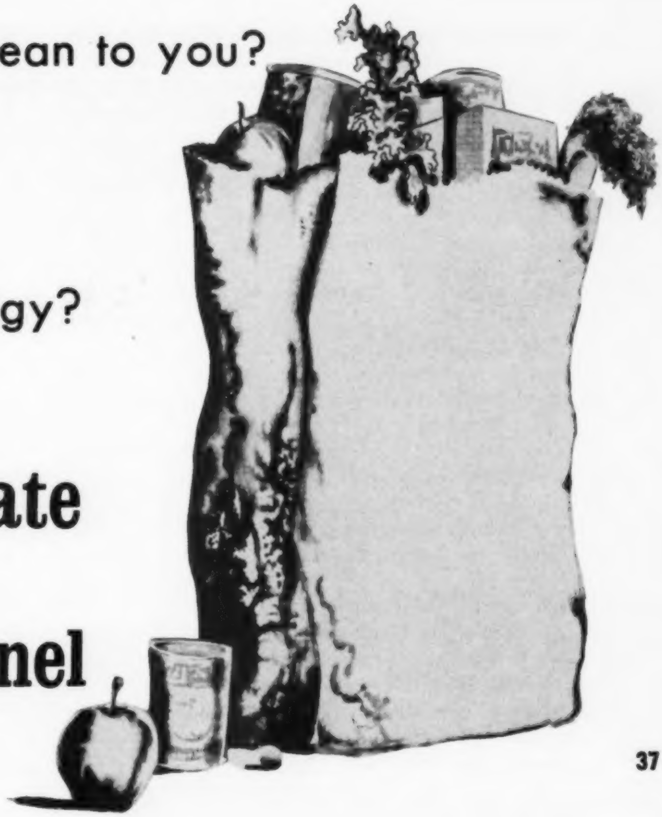
"I caught sight of the chute as it passed through about 1000′ and prior to water impact. I advised the orbiting aircraft that I had the chute in sight and told my copilot to start dumping fuel. We proceeded directly to the survivor in the chute and we were about two minutes west of him when he entered the water. We stopped dumping fuel at 800 lbs and, as we made our approach, I noted he was in his raft. I made an approach and hovered long enough for my rescue swimmer to enter the water beside the survivor. Then I broke hover, turning the controls over to my copilot. Approximately a minute later, I took the controls again and made a pass over the survivor. My crewman gave me a thumbs-up and I began an approach for rescue. I slowed the helo and commenced a hover over the survivor.

"My aircrewmen in the cabin did an excellent job of lowering the sling and cable. Within seconds, the survivor and my swimmer were hooked up and coming up into the helo. My copilot used the M-16 rifle to sink the life raft and we broke hover heading back to the ship. I reported to our orbiting aircraft that we had the pilot and that he was in good condition.

"In summary, the initial information concerning a possible SAR was good to have. As the position and intended flight path became known we proceeded on a course of intercept. Our Rescap had been with us throughout the entire sequence and no delay incurred waiting for them. The SAR ship gave us the tacan ranges and distances of the aircraft during its entire flight out and this information was valuable. If the pilot had been forced to eject over the beach or close to it, we would have been right there for the pickup. If he had ejected sooner than he did, we would have had to wait for the chute to enter the water before making the rescue. As it was, timing was just about perfect.

"My crewmen and copilot handled their jobs without hesitation and in a very professional manner. In fact, the entire helo rescue team did their jobs according to training and briefing and did not have to be told what to do." ◄

What does a big 'E' mean to you?
A carrier?
A rating?
An eye chart?
How about 'E' for Energy?



Low Carbohydrate Diet and Aviation Personnel

By LT Richard E. Carlson, MC,
Flight Surgeon, VR-21

However the physicists define energy, we'd have a difficult time without it. Various forms of energy light our lights, heat our homes and make the props go 'round. Let's consider how energy works in a particular engine, a biochemical engine, that all-too-often overstuffed clothes rack we call our body.

The fuel for our engine is food. The potential energy of food is oxidized to carbon dioxide and water with the release of energy. Instead of a violent release as in a combustion chamber, the release is slowly controlled by means of biological catalysts known as enzymes.

There are three categories of foods and each is used differently by our bodies to meet its energy requirements. These are carbohydrates, proteins and fats.

Carbohydrates are merely various forms of sugar and their storage complexes known as starches. Glucose is the most important sugar, used for "quick energy." A starch molecule is a very large unit composed of multiple simple sugar units. Starches are the ready reserve of food energy, usually stored in the liver.

Proteins are used chiefly as a building material and are only important as a source of fuel when other sources have been depleted. Such circumstances exist with advanced starvation when muscle wasting is quite apparent. Indeed, all that is left in such conditions is "skin and bones."

Fats serve as long range energy storage. Ounce for ounce, fat contains more potential energy, or calories, than carbohydrates or proteins. Fats can be converted into glucose under normal conditions and thus be oxidized in the usual manner. Fats are stored mainly in layers just beneath the skin. It may be said that many of us are bursting with energy.

Carbohydrates contribute little to our overall body weight. Protein and water constitute about 85 per-

cent of body weight in a lean individual. Therefore, the variable which increases or decreases weight is fat storage.

If the energy requirements of the body exceed what is available from our intake of food, the deficit is made up by utilization of stored food, carbohydrates for quick energy and fats for long range energy requirements. The carbohydrates in a normal meal are used first of all to replenish any deficit of starch. The remainder, if any, is converted to fat. It is important to note that the converse, the changing of fat to carbohydrate, can take place normally only when the carbohydrate is already available. There must be some carbohydrate present before the body can get any more by means of fat conversion.

The fuel line of the body is the blood stream. It is the means by which sugar is transported from the stomach to the cells. If there is too little sugar in the blood, the cells will not have enough fuel. The first cells to show this lack are the most sensitive cells in our bodies, the group known as the brain. The non-breakfast eater knows this situation when he gets the "mid-morning sinking spell." He does the correct thing in getting a sweet roll or a candy bar to raise his blood sugar level. If, on the other hand, there is too much sugar in the blood, the excess will be filtered off by the kidneys and excreted in the urine. "Sugar in the urine" occurs in persons with diabetes.

To be of any use, the sugar must get from the blood stream into the cells. This very important transfer is controlled by insulin. With a lack of insulin, the sugar builds up in the blood stream but cannot get into the cells where it is needed. The cells now begin to use fat for energy. But remember that fat is used normally only in the presence of carbohydrates. Without carbohydrate, there results incomplete combustion of fat with the production, not of carbon dioxide and water, but of substances which fall into the chemical class of ketones, the most well-known of which is acetone. These substances are quite toxic to our bodies, one effect being to lower the pH or make the blood more acid. Again the brain is the first to be affected by these substances. Death in an uncontrolled diabetic generally occurs as a result of the toxic effect of these substances on the brain.

These ketone products are also found in the urine and may be detected by placing a drop of urine on a certain kind of white tablet. A positive test results in the tablet turning a blue color.

A very important point for our discussion is that these ketone substances have caloric or food value. From a dietetic standpoint, the production of these substances with their excretion in the urine is a way of ridding the body of energy stores, or food, or fat, without exercise or actual use of the potential energy. Since we cannot stop the secretion of insulin in a non-diabetic, the next best thing to lower the blood sugar, thereby starting abnormal fat metabolism, is to limit the dietary intake of sugar. The starch stores are quickly utilized and then the body runs on fat in the absence of carbohydrate. As we saw above, this results in the incomplete combustion of fat with the production of, and excretion of, high energy ketone bodies.

This then is the essence of the low carbohydrate diet. Others refer to it as the drinking man's diet. Indeed, the best check to see if the program is working is to check the individual's urine with the tablet mentioned above. Only if it turns blue does it indicate the diet is producing the intended effects.

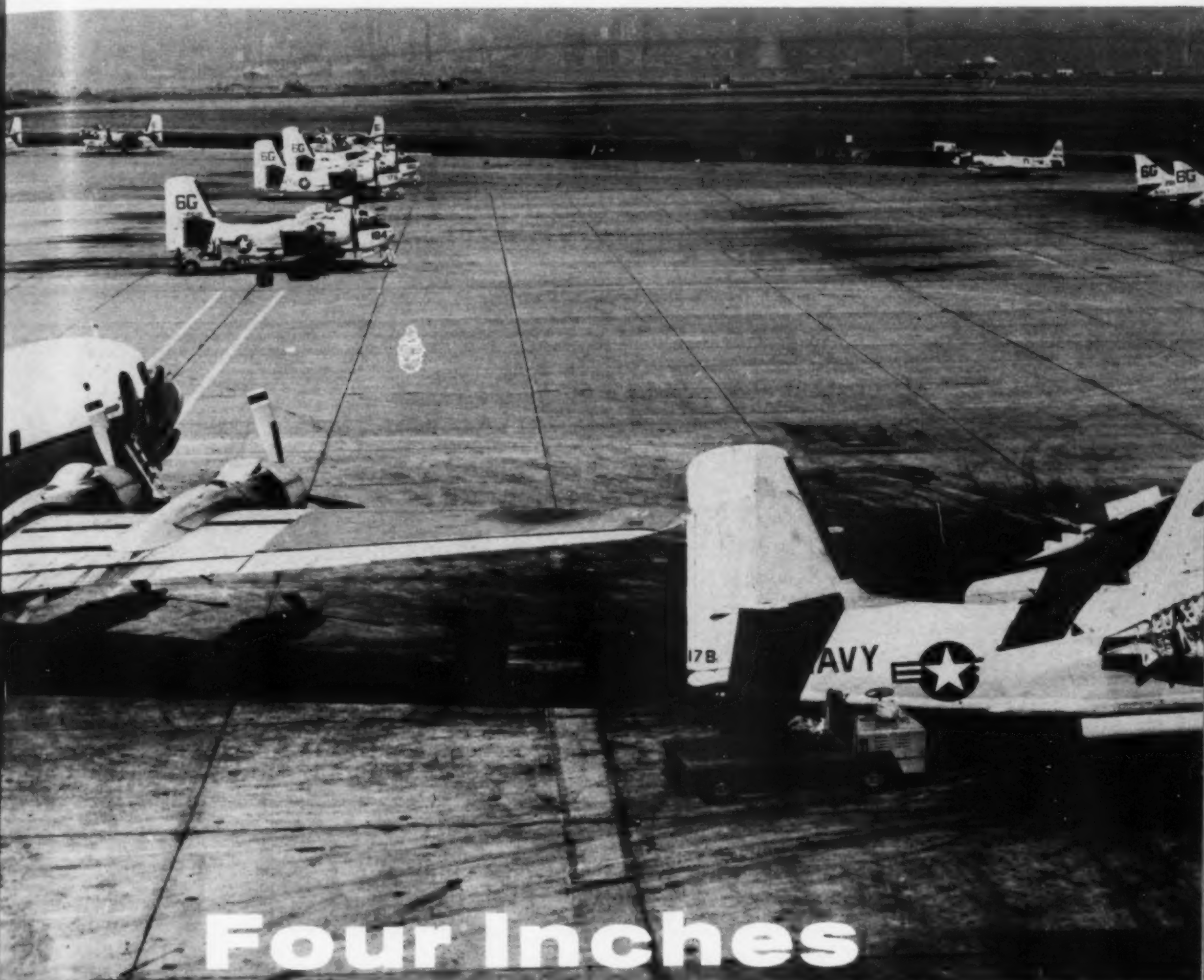
Please note the loaded situation in such a condition. There is low blood sugar *and* the presence of ketone bodies *and* the absence of starch stores. Most of us have experienced this situation to a more or less marked degree. Remember how you felt toward the final hours of SERE training? The Navy provided the low carbohydrate diet. Quick and strenuous activities were very difficult because of the lack of carbohydrates. Dizziness and lethargy were common because of the effect of low blood sugar on the brain. There was a shortness of breath and the breath reeked of acetone, a sickeningly sweet smell like fingernail polish remover. Remember how we were not allowed to even drive a car for 24 hours after the termination of the course? If this indeed represents the effect of a low carbohydrate diet, would you fly a plane?

Don't fly while on a low carbohydrate diet, gentlemen. In fact, it is good physiology to eat extra carbohydrate in the form of sweet coffee or a candy bar about a half hour before your approach.

This diet is reasonably safe while not flying *if* under close supervision of a person who understands the mechanisms and inherent dangers of such a diet. It should be discontinued at least 24 hours prior to flying and normal meals *high* in carbohydrates eaten so as to replenish the starch supplies.

Finally, as a bit of philosophy, a person who wishes to lose weight and remain slimmer must change his whole philosophy of eating. It is far more reasonable to diet by eating a well-rounded variety of foods but in smaller proportions, because that is exactly what must be done if a person is to keep his new weight constant. ◄

Have you noticed how widespread obesity is?



Four Inches Too Close

A C-118 aircraft was being towed out of a parking area. The tractor driver swung the aircraft to the left to clear an S-2 which was parked in front. Unfortunately, an inexperienced wing walker was being utilized and he *thought* there was sufficient clearance for the C-118's right wing to miss the rudder of the S-2. The tractor driver put too much trust in the wing walker. End results—two slightly crunched items, a wing tip and a rudder.

Considering that practically every American boy has a fair amount of car driving experience before he joins the service, it is hard to believe these same lads can be guilty of crunches such as this one, and all too many similar ones. If everyone would treat Uncle Sam's expensive equipment as if he personally owned it. the numbers of these crunches would be greatly reduced. How about it fellows? ◄

LIGHTW

What it is

How it works

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WATER

This newest of fire extinguishing agents is a noncorrosive, nontoxic chemical concentrate consisting of fluorocarbon surfactants and appropriate foam stabilizers. Six parts of the chemical concentrate mixed with 94 parts of ordinary water and properly aerated will result in this revolutionary foaming fire extinguishing agent. This light-water will commence controlling aviation fuel fires in seconds by floating on top of and therefore smothering the flaming liquid. Everyone knows pure water will not burn and should know it is heavier than avgas. The chemicals which are added to the water make its resulting foam lighter than avgas hence light-water—and smothered fires.

Development of light-water started in late 1962 at the Foam Laboratory of NRL when a search began for a foaming extinguishing agent that would be compatible with an improved dry chemical fire suppression agent for hydrocarbon fuels. The improved dry chemical, potassium bicarbonate, commonly called P-K-P (Purple-K-Powder) had an extremely fast flame knock-down ability but was not totally compatible with protein foam. When applied on a fire in conjunction with protein foam the P-K-P would accelerate the break down of the protein foam blanket which provided the density to vapor proof the hydrocarbon fuel. It should be pointed out that P-K-P, a free radical agent, has phenomenal fire knock-down power when used as a single fire fighting agent; however, it does not have time-extended fire suppression capabilities and will not suppress or contain the volatile flammable vapor from the remaining unburned fuel.

A 25 percent light-water concentration was found to be fully compatible and was used in conjunction with Purple-K-Powder in the TAU (Twinned Agent Unit.) The TAU was field tested and the results proved it to be very effective in providing a means of rescue but limited in capacity for full extinguishment of large fires. This unit is sometimes referred to as the Twinned Ball Extinguisher as both agents are contained in two aluminum spheres 28" in diameter.

Airborne Spray Tests

Tests to meet the need for an airborne system of fire extinguishment for use at air stations whose surrounding terrain is inaccessible to wheeled vehicles followed. It was found that the down-wash of the helicopter was sufficient to spray the light-water solution without the injection of refrigerant gas. This quickly secured the fuel fire and left a thin but effective layer of foam which vapor sealed the fuel surface.

Results documented in NRL Report 6573 stated that light-water was 3 times as effective as protein foam when used on avgas fuel spill fires and was 1½ times as effective as protein foam when used on JP-5 (Jet A) fuel spill fires. Light-water was compatible with P-K-P; protein foam was not. The liquid drain-off of light-water foam reduced the threat of flashback and reignition of fuel vapors. Light-water possessed an extremely fast flame knock-down ability by itself, equivalent to that of P-K-P applied at the same rate by weight.

It was found that light-water would knock down flames as fast as the solution could be applied. With proper techniques and personnel training, rescue paths can be made in seconds. Accordingly, crash

Crewman adjusts discharge rig.

Lightwater starts spewing from the helo.

Another man is saved.

crews require training to fully appreciate and utilize light-water capabilities. For example a 75 ft diameter fire fueled with 1200 gallons of avgas with a reburn time of 43 seconds was controlled sufficiently in 11 seconds to the extent that rescue operations could start. The fire was *totally extinguished in 53 seconds* using 12 gallons of 6 percent concentrate light-water proportioned with 185 gallons of fresh water. Two complete truck loads (MB-5) using a total of 50 gallons of protein foam concentrate proportioned with 800 gallons of water were required to control the fire in 90 seconds and extinguish it in 172 seconds.

One demonstration of a TAU mounted on a Code 707 line service vehicle was sufficient to convince the Deputy Chief of Naval Operations (Air) that such units were sorely needed on the flight decks of carriers on Yankee Station. Commencing 26 days later carrier crash crews were being trained at NAS Cubi Point and unit delivery commenced 5 days later. The mobility of these units, however, was restricted on the flight deck because they cannot be maneuvered around and under the wings of aircraft. The components of the Shipboard/Twinned Agent Unit (SB/TAU) were designed for other purposes without regard to height and accordingly serve as an interim measure only. Specially designed units for attachment to and in place of the aircraft starter unit on MD-3 Tow Tractors (SB/TAU-2) will replace the interim SB/TAU.

Today we have an improved fire extinguishing agent ready for use ashore—and afloat.

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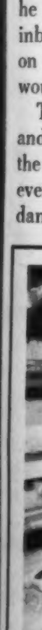

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Notes and Comments on Maintenance

Dangerous Crew Techniques

Just prior to launch from a carrier, the plane captain injured his back while attempting to remove the power cable from an S-2E.

During a normal engine start, the plane captain is posted between the starboard nacelle and the fuselage, standing by to pull the external power cable. In this particular incident the plane captain was under the impression that he was to pull the nose wheel tie-down as soon as No. 1 engine was started and then to pull the external power cable after both engines were started and running.

Prior to the start, the power jeep driver parked the jeep between the fuselage and nacelle, thus blocking passage from behind the engine to the external/main engine hatch area. The No. 1 engine was started and the plane captain elected to pass under the nacelle, between the turning prop and the starboard main mount. The plane captain was rushed and when he encountered the prop wash, he was thrown off balance. He came up under the inboard main wheel well door and raked his back on the corner, necessitating six stitches to close the wound.

This incident emphasizes the basic need for caution and coordination between flight deck personnel on the flight deck. A number of seemingly insignificant events took place here that added up to a potentially dangerous situation:

(a) The plane captain was not at his post during the engine start.

(b) The safest access route to the external power receptacle was blocked.

(c) The plane captain was rushed.

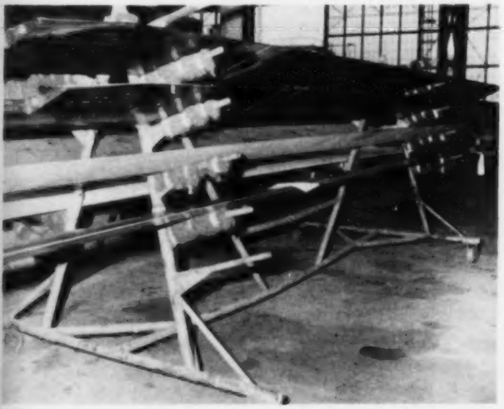
Because of this situation, he was tempted into an extremely hazardous area where, had he tripped and fallen into the prop, he might have lost his life. Extreme caution and coordination among flight deck personnel is required to complete a successful launch without the occurrence of mishaps. A breakdown of either or both of these, no matter how insignificant, can lead to disastrous results.—*Anymouse*

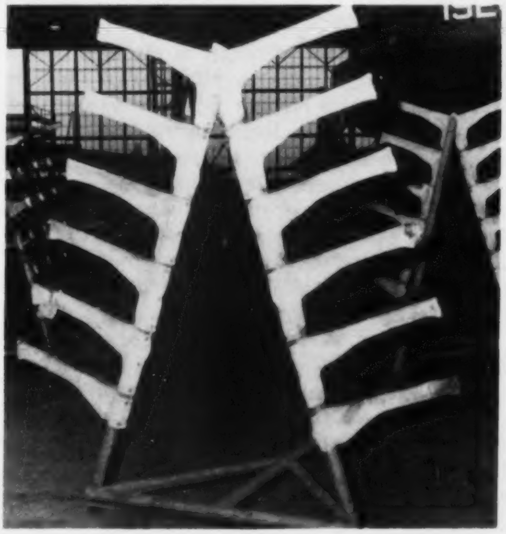
Worth Quoting

"The unit involved realized this was more than a simple case of maintenance oversight. They took a second look at the atmosphere which allowed this mishap to occur, and had some words for their maintenance supervisors. . .

"Effective immediately, during all maintenance on downing gripes where assembly of a unit may affect safety of flight, the maintenance supervisor authorized to clear the discrepancy will monitor the complete maintenance from beginning to end. . .

"Come to think of it, on a job of this nature, how can a responsible man sign the release with a clear conscience . . . unless he *has* watched the entire assembly operation?"—*TAC Attack*





Helo Rotor Blade Stowage Rack Improved. By increasing wheel base from 36 inches to 68 inches as shown in the accompanying photos, greater rack stability reduces possibility of accidental overturn. Time and cost to effect this modification is nominal but blade benefit is high.

—Contributed by HC-6

Using 3-M Data at Local Level

Are You Getting Your Share?

The 3M system is now in full swing and meaningful maintenance data is generated and processed at an enormous rate. End products will help your maintenance operation only if you learn to use them—

Now that the 3M system has been implemented in most naval aviation activities performing organization level maintenance, more than 3 million EAM cards are being processed monthly. A comprehensive set of reports is being provided the higher levels of management but there's gold in there for those working the mines too.

It is time now for managers at the local level to look over these reports to determine if they are getting the benefits of their inputs. Here's an indication of the potential built into the system. If you don't know the answers to these questions—you are not getting your share of the benefits.

- How much support does the intermediate maintenance activity provide my activity?
- To what degree is overtime employed?
- Is the maintenance department attaining the desired level of production?
- How many manhours are expended on non-aeronautical equipment?
- Are components being removed unnecessarily?
- Are the technical qualifications of assigned maintenance personnel being advanced through training?
- What is the production level of each work center?
- To what extent do work stoppages or delays affect the productivity of the work centers?
- What is the status of the technical directive co pliance program?
- Is the assigned labor force properly distributed
- How often is a need for maintenance foun during quality control inspection?
- What malfunctions contribute to aborts?
- Are flight hours equitably distributed amon the possessed aircraft?
- How extensive is cannibalization?
- Are indirect labor expenditures reasonable?
- Do job manhours exceed accepted standards?
- What portion of the not operationally read hours is the result of aircraft awaiting maintenance
- What is the utilization rate for possessed ai craft?
- Has sufficient work been scheduled for the wor centers?
- Which components are high consumers of mai tenance manhours?
- What factors are reducing aircraft readiness?
- Do any of the assigned aircraft show a su tained high maintenance manhour per flight hou cost?
- Which components are being cannibalized?
- What impact does nonavailability of requi tioned material/components/parts have on aircra

operational readiness?

• Which components are involved in NORS conditions?

• How many flying hours/sorties can be expected from the possessed aircraft?

• Will sufficient direct labor manhours be available to accomplish the projected maintenance workload?

• Does the predicted aircraft flying hour/sortie capability compare favorably with known operational commitments?

If the answers to many of these questions are unavailable or obscure, you may be overlooking the potential of the MHA, MDR and ASD reports available under the 3M MDCS.

Direct answers to many of these questions may be obtained from the reports. For others, the reports may only indicate facts which through analysis will ultimately lead to the answers.

The manner in which you, the manager, use data collected through the 3M system to get answers is limited only by your initiative and imagination.

The Spring issue of "*MECH*" detailed NAS Patuxent River AMD's approach to the job of extracting useful information from the various 3M reports. There are many other approaches, and "*MECH*" solicits details of applications of 3M data at the organizational maintenance level to specific problem areas, *whereby flight safety has been enhanced.*

AVCM Hugh Brainard, NARTU, NAS Jacksonville, describes one approach to the use of 3M data, illustrating the potential of the system:

"We conducted a study over an 11-month period. It involved an average of 30 A-4Bs, three T-33s, 15 P-2s, three C-45s, 12 S-2s and five SH-34Js which operated a total of 27,532 flight hours.

"The study revealed that AN/ARN-21B (and D) tacan systems operated 23,066 hours in all aircraft with 364 discrepancies for a reliability of 63.3 flight hours per discrepancy. Considering the A-4B tacan gripes separately, there were 139 discrepancies in 5511 flight hours or 39.6 flight hours per discrepancy, while tacan reliability in other station aircraft (not including the A-4B), was 78.0 flight hours per discrepancy.

"Alerted by these statistics, an investigation was made which showed that the tacan in the A-4B is mounted rigid to the airframe, while it is shock-mounted in all other aircraft. It was also noted that the retaining bolts and wing nuts of the A-4B tacan racks were stripped and/or bent on many installations. The line electronics personnel stated that the cause of this was that many tacan discrepancies could be cleared by tightening the box in the rack.

"The following corrective measures were taken at the next calendar inspection of each aircraft:

(1) The tacan rack was reworked to allow a one-eighth inch greater penetration of the rack plug into the black box receptacle.

(2) Damaged retaining bolts and wing nuts were replaced.

(3) New air filters were installed.

"Eight months later, A-4B tacan reliability had improved 24 percent even though overall tacan reliability was down by 14.5 percent. It was considered that the G forces on the black box, as the nose fell through on landing, were jarring the tacan loose in the rack."

This example is not earth-shaking, to be sure, but it is a step in the right direction—making use of available 3M data at the local level. The list of questions posed earlier in this article gives a good indication of the *range* of potential benefits, but it is not intended to be a complete roundup of the *capability* of the 3M MDCS at the local level.

Here are some thoughts for the manager to keep in mind as he approaches the task of using 3M data at the local level:

Do Not

• Be discouraged by an imagined need to be an expert on the entire system and all its ramifications before attempting to extract useful information from the system.

• Saddle the data analyst with all the responsibility for analyzing data, nor abdicate your responsibility for making decisions based on data collected.

• Reject the entire system if it is not responsive to *all* your needs in *all* areas. Do your bit to improve and refine the system.

Do

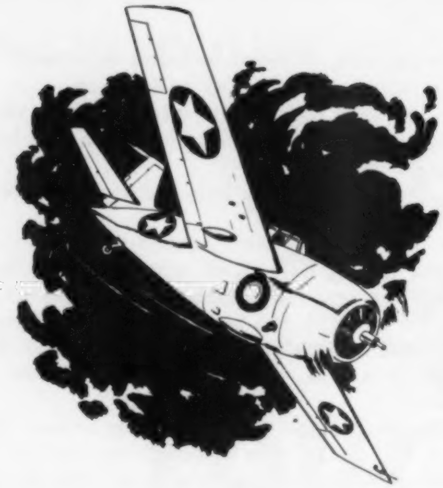
• Utilize your data analyst's capability. He is a highly trained individual, well equipped to assist you in developing and analyzing data.

• Encourage all maintenance and material supervisors to use *their* initiative in analyzing 3M data for management improvement.

• Strive to work within the framework of the system. Realize it is not perfect, that it is still in a state of evolution.

• Strive to improve the accuracy of the data collected at the local level. Incorrect or unreliable data cannot be expected to support effective management decisions.

Finally, realize that it is up to you, the manager at the local level, to provide the imaginative leadership which is necessary to insure the fullest benefit from the system's potential. ◄



Want your safety suggestion read by nearly a quarter of a million people in naval aviation? Send your constructive suggestions to APPROACH.

Letters

Don't keep safety suggestions to yourself, take one home to dinner this week!

Ability and Experience

FPO, Seattle, Wash.—Knowledge plus Ability plus Experience equals a Professional Aviator. (K+A+E=PA)

All naval flight students are evaluated before assignment to Pensacola. These evaluations include detailed physical examinations as well as the scores achieved on certain tests. Each potential naval aviator must demonstrate, by one of several recognized means, that he possesses certain knowledge. Often being a college graduate will qualify him. Sometimes the fact that he is a commissioned officer is acceptable proof that he possesses the basic knowledge necessary to enter Naval Air Training. But little is expected in the way of actual experience in airmanship; it appears to be a thing that must be actually experienced. Of course, it can be argued that true ability is very difficult to measure. But this can be answered by analyzing the records available at the Naval School of Aviation Medicine at Pensacola. As a result of much valid research, certain tests have been proven good indicators as to whether a potential flight student will ever become a naval aviator.

Therefore, the product that reports to the fleet, both Marine and Navy pilots, is considered knowledgeable enough to become an accomplished aviator. By performance data on others who have gone before, it can be deduced that they all possess a certain level of ability. But if these young aviators all possess a certain level of ability and aeronautical knowledge, they also *all* lack aeronautical experience.

Thus, squadron commanders are faced with an analytical task. Their young aviators must be trained as rapidly as possible to be fully checked out in type. Yet this must be done within the perimeter of safety. Our combat posture is not inducive to extra time in checking out. Everyone recognizes that an A-4 pilot's value is very limited if he cannot hit the target while a weak instrument pilot could hardly be qualified as aircraft commander in a C-130. Regardless of the different levels of ability, aeronautical knowledge and experience, the new aviator has to be developed to a certain standard of flying proficiency.

This is the difficult part, as this level of proficiency cannot be measured. Every former flight instructor has faced the same problem numerous times. Was the student ready to proceed or should he be given more time in stage?

The new aviator in his first operational squadron begins to rapidly acquire experience: aeronautical experience—some through trial and error and some by observation, demonstration and performance. He builds upon his already possessed knowledge and sharpens his flying ability. He begins to really understand the hardware he flies. Yet the value of his experience is a major variable. Each pilot's flying performance has to be carefully analyzed, *and it is here that we, in supervisory and command positions, often err!*

Many an aircraft has been damaged or lost and personnel injured because a pilot's ability and experience were confused. Several hundred hours of safe flying for a second lieutenant or an ensign certainly increase the pilot's aeronautical experience. It does not *have* to increase his ability. This is especially true of his ability to make proper decisions under stress, to think.

So what happens? A pilot with six or seven hundred total hours of flight time is trapped by his experience! Sounds ridiculous but it happens. Take helicopter flying in Vietnam for example. A Marine lieutenant can find himself and his aircraft in a situation that demands *both* experience and a high level of ability. Because of a few hundred of hours of satisfactory flying, for example, an average aviator is assumed to have increased his ability. Suppose he hasn't. He is trapped in that his flying ability has not increased in proportion to his flying time.

This is the pilot we must look for and try to identify early. He is our potential accident with all its undesired results. With tremendous flying ability, natural if you will, (all aviators

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request.

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know what this undefinable quality is), a pilot under difficult circumstances may make out with limited experience. But a pilot with only average ability and short of real decision-making experience could find himself in serious trouble.

This is a problem that must receive command attention. There are numerous ways to handle it but the important part is not in attacking the problem. It is recognizing it exists *before* that accident *occurs* which is attributed to pilot error. Let's don't get the three items, knowledge, ability, and experience, mixed together. Each is a separate entity and demands to be evaluated alone. Aeronautical experience and ability are *not* the same!

LTCOL F. E. ALLGOOD
HMM-363

P-3 Engine Inlet Covers

FPO, Seattle, Wash.—A rather dangerous situation exists in the P-3 aircraft in that personnel have to climb out on each engine nacelle to remove or install the engine inlet covers. This maneuver is dangerous in itself, but when you add moisture, snow or ice to the top of the nacelle, you are literally asking a man to risk his life to install these covers. Several solutions come to mind. First, the covers could be redesigned so that they could be installed from the ground. However, due to the location of the inlet, this does not seem to be feasible. An easier solution would seem to paint the top of each nacelle with some antiskid type paint.

VP SQUADRON
AVIATION SAFETY OFFICER

▶ Asking a man to install or remove P-3 engine inlet covers via the wing and nacelle *is* literally asking him to risk his life, with or without antiskid paint, particularly if the wing and nacelle surfaces are ice or snow-covered—unless additional measures such as safety lines are employed. The safest method, and the one recommended, is to have the crewman use a suitable ladder to accomplish this task. Page 41 of the December 1967 APPROACH contains information on a suitable ladder, FSN RM 1730-014-1519, along with details for modifying it for improved stability. Crewmen should be *positively* discouraged from accomplishing this task by walking over the wing and out on to the nacelle.

'A man of your caliber can go a long way, Beebe.'

CORRECTION

In the answer to the letter titled "Strobe and Vertigo II," page 47, June issue, ST-5E strobe light should have read SDU-5E strobe.

Vol. 14 **approach** No. 3

Our product is safety, our process is education and our profit is measured in the preservation of lives and equipment and increased mission readiness.

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Next Month

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Formula for Control

Have today's aircraft become so sophisticated that a pilot can ignore the old "stick-and-rudder" bit he learned years ago?

In a recent conversation with an airline flight operations executive the opinion was expressed that ". . . with today's hydraulic steering (hence, easier) of large aircraft, nosewheel steering, et al, pilots seem to have grown away from the aerodynamic techniques that once were required to maintain control of the less sophisticated earlier models."

The proponent of this idea went on to suggest that ". . . in too many cases pilots rely solely on nosewheel steering once the big bird is on the ground . . . and too often they end up with a slide-off-the-runway accident."

As a safeguard against this sort of thing, our friend suggested that during approaches under crosswind, gusty and/or other adverse wind conditions, pilots would be wise to give maximum care and attention to the control of the aircraft through all phases of approach, round-out, touchdown and rollout. After the aircraft has been firmly and correctly planted on the runway and is directionally stable, they should continue absolute control of the aircraft by using all controls to maintain a straight roll until the aircraft has slowed to its taxiing speed. This means adhering to the old tried-and-true "upwind aileron to hold the upwind wing down and increase drag on the downwind wing," thereby keeping up the guard against a weather-cocking tendency and using rudder to keep the nose straight, in case a deviation sets in because of a lack of tire friction or whatever.

Basically, all this is the long way of recommending that today's pilots remind themselves of the age-old and proven techniques of aerodynamic control during approach, and right on through rollout, instead of relying completely on the nosewheel steering system. As our old-hand stated it, "It'll sure help avoid loss of directional control accidents and incidents!"

—Courtesy Flight Safety Foundation

LIFT and DRAG